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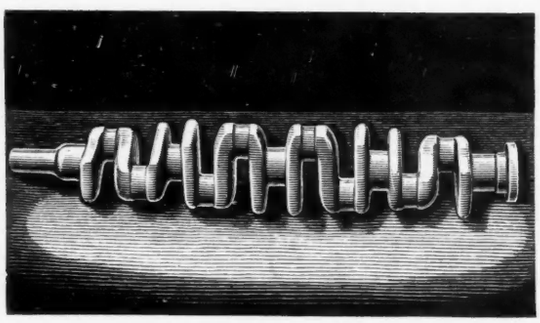
Ask for manufacturer's license.

C. ALBERT & CO.
Wuppertal-Barmen (Germany)



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THE CRANKSHAFT MAKERS
Worcester, Mass.-Harvey, Ill.-Detroit, Mich.

AUTOMOTIVE INDUSTRIES
The Automobile

Reg. U. S. Pat. Off.
Published Weekly

Volume 77 — Number 26

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New York—239 W. 39th St., Phone Pennsylvania 6-1100. Chicago—Room 916, London Guarantee & Accident Bldg., Phone Franklin 9494. Detroit—1015 Stephenson Bldg., Phone Madison 2090. Cleveland—609 Guardian Bldg., Phone Main 6860. Washington—1061 National Press Bldg., Phone District 6877. San Francisco—444 Market St., Room 305, Phone Garfield 6788. Long Beach, Cal.—1595 Pacific Ave., Phone Long Beach 613-238.
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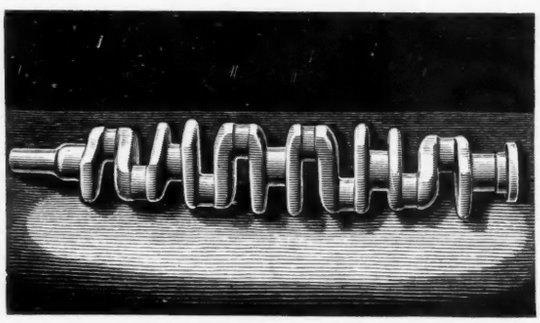

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AUTOMOTIVE INDUSTRIES

December 25, 1937
Vol. 77, No. 26

Output Pace Hinges on Sales Rate

New and Used Car Stocks Must Be Substantially Cut Before Production Schedules Can Be Stepped Up

Before any appreciable improvement can come in the operating rate of the automobile industry, there must be a substantial reduction in both new and used car stocks which are now at the highest level of the year. So sharp has been the contraction in retail sales during recent weeks that, although the factories have been steadily curtailing output, production up to about the middle of December continued to outrun retail deliveries and field stocks kept mounting. Operations in the last half of the current month, however, have been so drastically cut that at least a balance has been reached with sales, if not a reversal brought about in the trend of stocks.

From now on, dealers new car inventories should recede until about the start of the spring selling season, at which time the condition of demand will determine whether it will be necessary again to build them up. Even at present level, they would be adequate for a brisk spring trade, for at the end of November passenger car stocks alone exceeded the number of cars in the field on April 1 by 52,000 units and were nearly 16,000 units higher than the previous 1937 peak reached July 1. They were up 35 per cent over the level of a year ago. At that time, however, there was a substantial shortage in the field due to the many interruptions by labor difficulties. But demand was also at near record proportions, a situation which does not exist now, nor is it expected to be paralleled next spring.

Thus, in contrast with conditions in the fall of 1936 and the first half of 1937, when production was the limiting factor on sales, now the rate of sales is the limiting factor on production. For at least the next two months it can be expected that automobile output will be kept slightly under the level of retail deliveries. That undoubtedly means that the low point in output has not been reached. The retail automobile business enjoyed some stimulus from Christmas buying, although a counter influence is the early and severe winter weather. For several weeks the industry's best markets have been blanketed in snow and ice, which is an adverse factor in the best of years. Unless the weather is exceptionally favorable, January is likely to be a very lean month for retail sales, and it is expected also to mark the low point in production.

About half of the car manufacturers are closing their plants this week-end and will remain inactive until Jan. 3. In some instances, certain manufacturing departments will not resume until the middle of Jan-

(Turn to page 891, please)

T. M. ROBIE

. . . who was recently named manager of the Diesel sales division of Fairbanks, Morse & Co., Chicago.

Next Few Months Critical for UAW

Union Hard Hit by Drastic Curtailment in Its Income With Leaders Estimating 45% of Members Unemployed

The next few months are likely to prove a critical period for the United Automobile Workers union, which is suffering from drastic curtailment of its income as well as lagging interest on the part of workers as result of wholesale layoffs by automotive plants. Disaffection of members is said to be growing with increasing unemployment, for which many blame the union. A big percentage of automotive workers face extended layoffs this winter and many will be permanently taken from the payrolls where they are now registered. It is generally expected that the employment situation will be worse for some weeks after the first of the year.

Union leaders already estimate that 45 per cent of their members are not working, and those still employed are for the most part on part time. Dues are required to be paid by members who have five or more days of work in a month, and to date payments have been coming in remarkably well, according to UAW officials. But the slack period in the industry is still young, and outside observers foresee a very lean period ahead for the union, some going so far as to predict a decimation of its ranks to the point where it will be seriously crippled, if not reduced to impotency, for some time to come.

There are those who regard the first quarter of 1938 as a crucial period for the UAW under the CIO, and would not be surprised if an entirely new set-up of independent

(Turn to page 890, please)

Dealers vs. Factories

A Sub-committee of the House of Representatives Conducts Public Hearings on a Resolution to Investigate Their Relations

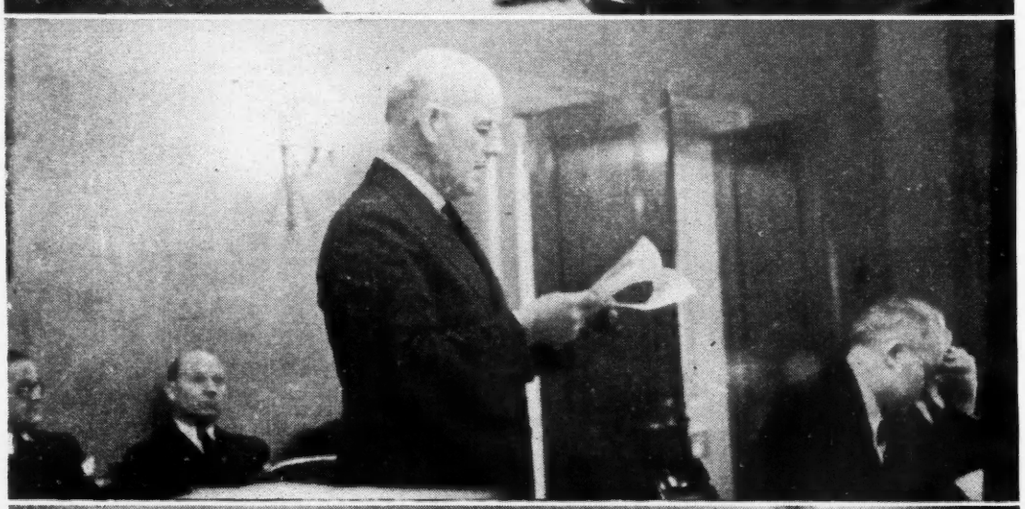
On May 28, 1937, Representative Withrow introduced into the House of Representatives a joint resolution (H. J. Res. 389) which if passed would direct "the Federal Trade Commission to investigate the policies employed by manufacturers in distributing motor vehicles, and the policies of dealers in selling motor vehicles at retail, as these policies affect the public interest."

The resolution was referred to the House committee on Interstate and Foreign Commerce, which appointed a sub-committee to report on it. In Washinton, Dec. 16, 17 and 18, the sub-committee conducted public hearings on the advisability of such an investigation.

Case favoring an investigation was opened by Arnon N. Benson, general manager, National Automobile Dealers

SUB-COMMITTEE

At the table's corner, Rep. Gardner R. Withrow, resolution's sponsor, listens attentively. At left of picture, Rep. Carl E. Mapes appears to ponder one of the penetrating questions with which he enlivened the hearing. At Withrow's left is Rep. Robert Crosser, chairman of the sub-committee.



MACAULEY

To his original statement of the manufacturer's position, Mr. Macauley added the following summary: "Mr. Benson would like these proceedings conducted with a minimum of publicity. I do not impugn his motives, but we do not agree with him. Charges have been made against the manufacturers that so far, it seems to me, have been slightly supported. If these charges are worthy of serious consideration, testimony concerning them should be laid before the interested public that already is aware of the charges made."

HUTCHINSON

Practices of the automobile industry in relation to its dealers have benefited the public rather than harmed it, testified B. E. Hutchinson, vice-president of the Chrysler Corp., who insisted that "no goods are ever shipped to a Chrysler dealer unless ordered."

Contax Photos by Elliot Curtis

Association, with interpolations by Edward Payton, analyst.

Alvan Macauley, president of Packard and of the Automobile Manufacturers Association, headed the presentation of manufacturers' point of view with a statement that "if after full public hearing of what the proponents of this resolution desire, this committee and the Congress believe that a useful public service will be rendered by ordering an investigation we shall have no objection, but ask only that Congress specify to those making the inquiry that it is not seeking to raise costs to the consumer by any price-fixing device or artificial curb on distribution."

1

2

1—DISSENTIENT Most dealer representatives present testified to the need for an investigation. S. W. McMichael, manager, Michigan Automobile Trade Association, reversed the trend with a bald statement that "Our dealers in Michigan can see no good in such an investigation."

3

2—DOCUMENTS Arnon N. Benson (center), general manager, National Automobile Dealers Association, waits a chance to bombard the committee with some of the documents prepared by the N.A.D.A. At his right is Roberts, general counsel for the association, who summarized the dealers' position on the last day of the hearings. Said Benson: "All we want is that the Federal Trade Commission should make an investigation. If the present system of relations between manufacturers and dealers is found to be all right from the public's viewpoint—OK. If not, something probably should be done to correct it."

4

3—ATTENTIVE R. H. Grant, General Motors vice-president and sales director, and Mr. Macauley. Questions from the sub-committee brought Mr. Grant to his feet several times during the second day of hearing, with requests to be allowed immediate hearing. Denied the privilege, Mr. Grant opened his own testimony with a challenge to the proponents of the Resolution: "What is coercion and what is aggressive salesmanship?"

5

4—WORDS and PICTURES

John W. Scoville, Chrysler economist, charted dealer mortality (declining) and dealer profits (rising) for the benefit of the committee. Figures presented by Mr. Scoville were used to fortify manufacturers' argument that automobile dealers are better off than dealers in most other businesses and that their returns on investment often exceed those of the factory by which they are franchised.

5—WATCHFUL WAITING

At the right of the picture Pyke Johnson, Washington vice-president of the Automobile Manufacturers Association, and Alfred Reeves, the association's vice-president and general manager, view the course of the hearing.

Contax Photos by Elliot Curtis

MEN OF THE INDUSTRY

J. E. MACMAHON, has been appointed general sales manager of the Graton & Knight Co., Worcester, Mass., to succeed C. O. Drayton, who recently resigned.

M. S. BROOKS has been named president of the Studebaker Corp. of Canada, Ltd., Walkerville, Ont. Prior to his promotion, Mr. Brooks had been vice-president and general manager extending over a period of three years.

FRED W. CEDERLEAF has been appointed general manager of the Diesel Equipment Corp., Chicago. Mr. Cederleaf's new position was incorrectly reported as general sales manager in the Dec. 18 issue of AUTOMOTIVE INDUSTRIES.

Critical Months for UAW

(Continued from page 887)

organizations were the outcome. Disintegration, they point out, is rapid, once it begins, and cite the case of the Mechanics Educational Society, which had complete control of tool and die workers back in the fall of 1933. Their strike during the new model season of that year was effective in completely tying up the industry for a while, delaying by many weeks some new-car introductions. Yet, within a year the MESA had about folded up and now it is hardly a factor in the trade.

It seems almost certain that the UAW will be in a weakened position to negotiate new contracts with companies whose present agreements expire during the winter or spring. Homer Martin has had several conferences recently with John L. Lewis, and it is rumored that the latter advised against attempts to seek revision of contracts during the business recession. UAW officials deny, however, that Lewis was opposed to the union's attempt to revise the GM contract, but admit that he counseled conservative action and concentration of efforts to hold what gains have been made.

Formal notice has been served on General Motors that certain changes are desired in the existing contract and that reopening of negotiations would be asked. Proposed revisions, worked out in weeks of negotiations this fall, were unanimously rejected by representatives of GM locals. The existing contract with GM has no definite expiration date, but can be terminated on 60 days' notice by either party. Agreement with Chrysler Corp. expires March 31, the Hudson contract on April 8, and Packard's on May 1. Most of the contracts with parts manufacturers have no specific expiration date.

Ford to Continue 4000 a Day Rate

The Ford Motor Co. has announced that the assembly of more than 4000 Ford V-8 cars and trucks a day will continue throughout the holiday season with the exception of two days, at Christmas and at New Year's.

The statement issued further reported that the January schedules call for approximately 4000 cars and trucks daily for five days a week.

Operations will be resumed on Jan. 17 by a number of departments which closed temporarily Friday in order to balance inventories which were built up during the last few months before 1938 car assembly started.

Crystal Gazing

Tool and Die Makers Encouraged By Automotive Inquiries

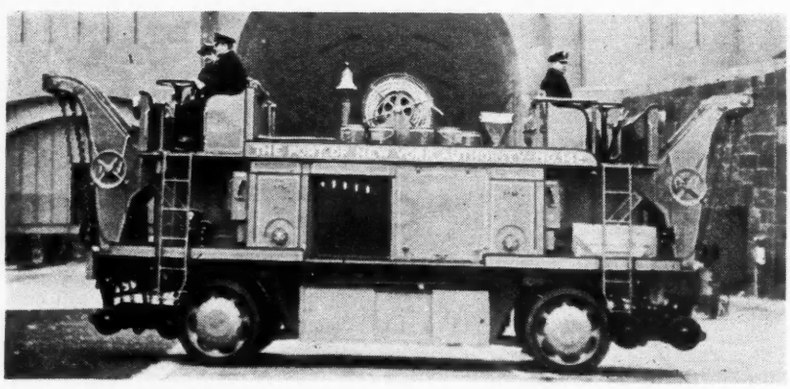
Based on inquiries already received by Detroit tool and die makers for next summer's retooling programs of the automobile manufacturers, preliminary reports anticipate good business for the tool and die makers in the first eight months of 1938.

That orders this year were far below average is attributable to the limited body and engine changes on 1938 models. Also, orders were late in arriving at the tool and die shops and when they did appear in the late spring and early summer, congestion was the result at a number of shops. The acuteness of the situation was enhanced by a shortage of skilled die workers developing in July. Hence, so that orders could be filled on schedule, the die shops had to work their employes overtime at the high wage rate established by union contracts.

Experience of the current year coupled with the knowledge that capacity of tool and die shops will probably be taxed by anticipated extensive 1939 model changes has led automobile manufacturers to prepare die specifications at an earlier date than a year ago.

Profit possibilities for the tool and die companies will hinge to considerable extent on stable labor relationships.

Among Detroit companies with listed stocks standing to benefit from the indicated increase in tool and die business next year are the Allied Products Corp., Detroit Gray Iron Foundry Co., and the Ex-Cell-O Corp.



Acme photo

TUNNEL TOW TRUCK

New type emergency service vehicle designed for use in the recently opened Lincoln Tunnel connecting midtown Manhattan, New York city, with Hoboken, N. J. (see AUTOMOTIVE INDUSTRIES, issue of Dec. 11, p. 824). Built by Mack, the huge truck is equipped with the latest in fire-fighting apparatus, including an inhalator, extinguishers, and acetylene torch. The vehicle is gasoline-electric driven, and has an electric motor on each end. It may be steered from either end.

Specifications of the unit state that it develops 10,000 lb. draw bar pull, and will tow a 70-ton load up a 3½ per cent grade at 20 m.p.h. Cranes and winches at both ends are designed to carry a 10-ton load suspended. Under each end is located a 12-ton four-wheel dolly.

Steering is hydraulic and the turning radius less than 22½ ft. All four wheels are equipped with Westinghouse air brakes.

. . . slants

SAFETY GLASS IN INDIA—*Certain business firms in India are urging that an amendment be passed to the Motor Vehicle Act to provide that all motor cars in India be equipped with safety glass in an effort to reduce injury in automobile accidents, according to a report to the Department of Commerce by the office of the American Trade Commissioner, Calcutta. Motor cars*

without safety glass are not permitted on the highways in the United Kingdom, and it is being urged that such a stipulation be included among the extensive provisions now being formulated in the Indian Motor Vehicle Act of 1914, the report stated.

Indict Aircraft Makers

Charged With Violating Embargo On Sale and Shipment of Arms

Indictments charging violation of the 1934 neutrality embargo on sale or shipment of war implements to the principals in the Gran Chaco war in South America have been brought against the Curtiss-Wright Export Corp., the Curtiss Aeroplane and Motors Co., Inc., and the Curtiss-Wright Airplane Co., along with several other companies.

The indictments, which are concerned in part with the alleged sale of four Condor bombers, three pursuit planes, bomb racks, and airplane spare parts, were delivered this week by the Federal Grand Jury to Judge Henry W. Goddard in the United States District Court.

Also named in the indictments were John S. Allard, president of the Curtiss-Wright Export Corp.; Ralph S. Damon, president of the Curtiss Aeroplane and Motors Co.; and Clarence W. Webster and Clifford K. Travis, the Curtiss-Wright Airplane Co.

Output Hinges on Sales

(Continued from page 887)

uary. In general, the new year will open with assembly operations on a very restricted basis, with two- and three-day weeks in effect at a number of plants.

Graham is the only company continuing full-time operations of five days a week through the holiday season. Ford cuts down to four days for two weeks, resuming the five-day week at the start of the year. Of the GM divisions, Chevrolet and Cadillac plan part-time operations during the week between Christmas and New Years. Others will be closed until January 3. Packard and the Chrysler divisions will be down for the holiday week. Hudson planned to operate three days, and Hupp probably two days. Willys-Overland closed for the year Dec. 16 after building 80,000 cars in 1937.—H.E.G.

Acme Photo

TELEVISION TRUCKS

Recently delivered to the National Broadcasting Co., Radio City, New York City, were two Mack trucks for the first mobile television station in the United States. The two vehicles, which are connected by coaxial cable when the station is in operation are completely equipped with apparatus for picture pick-up of outdoor news events and transmission with accompanying sound. Set up on the roof of the truck pictured are an iconoscope camera and a special parabolic microphone. Bodies for these trucks were built by the York-Hoover Body Co.

Pierce-Arrow Seeks Reorganization

Files Petition Under Section 77B of the Bankruptcy Act For "The Purpose of Preserving the Status Quo"

Pierce-Arrow Corp., Buffalo, N. Y., filed a petition this week seeking reorganization under section 77B of the Bankruptcy Act. Arthur J. Chanter, president of the company, said that the action was taken for "the purpose of preserving the status quo until the company's plans for reorganization can be successfully consummated."

Approval of the petition as filed was given in Federal court by Judge John Knight who named Jan. 17, 1938, as the first hearing date.

Mr. Chanter further stated in this connection, "The adverse conditions prevailing in the securities market since the reorganization plan was approved by stockholders has so far made it impossible to carry out the plan and the board of directors of the company has deemed it to be in the best interests of creditors and stockholders alike to seek the protection of the court."

Stockholders had approved the reorganization plan on Sept. 2 and a new corporation was to be formed, acquiring assets of the present corporation. Sale to underwriters of 1,300,000 shares of stock in the new corporation totaling $10,700,000 was also contemplated.

Other details of the plan called for exchange of one share of common stock in the new corporation for five shares common of the present company, with preferred stockholders receiving one share of new stock for two shares of the old.

Argentine Imports Gain 95%

American automobile units imported into Argentina during the first 10 months of 1937 numbered 37,161, an increase of 95 per cent as compared with the 19,051 units imported during the corresponding period of 1936 and accounted for 93 per cent of the total imports during the period under review, according to a report made public by the Department of Commerce.

Total imports of automobiles and trucks into Argentina during the first 10 months this year amounted to 39,953 units, compared with 20,953 units during the corresponding period of 1936—this is an increase of more than 93 per cent.

Automotive imports into Argentina from European countries also showed a decided increase during the first 10 months of 1937 when compared with the corresponding period of 1936. Total European automotive imports into Argentina during the first 10 months amounted to 2792 units compared with 1624 units imported during the corresponding period of last year, a gain of almost 72 per cent.

Business in Brief

Written by the Guaranty Trust Co., New York

The decline in general business activity was halted last week. The index of business activity compiled by the *Journal of Commerce* stood at 76.3, as compared with 75.0 the week before and 100.9 a year ago. The Secretary of Commerce recently issued a statement to the effect that industrial production is running below the need for supplies and that inventories are rapidly being absorbed. It was also announced that indications point to a volume of Christmas trade about the same as last year.

Freight Loadings

Railway freight loadings during the week ended Dec. 11 totaled 622,131 cars, which marks a decline of 1206 cars below those in the preceding week, a decrease of 116,965 cars below those a year ago, and a gain of 5481 cars above those two years ago.

According to the Department of Labor, retail food costs during the month ended Nov. 16 declined 1.5 per cent. The decrease was mostly the result of a sharp fall in the prices of meat. The current index is lower than at any time since December, 1936.

Production of electricity by the electric light and power industry in the United States during the week ended Dec. 11 was 2.1 per cent below that in the corresponding period last year.

Corporation Profits

According to a recent report of the Federal Reserve Bank of New York, corporation profits during the third quarter of this year were 19½ per cent above those in the corresponding period in 1936. The increase above a year ago, however, was smaller than in earlier months.

The volume of store chain sales during November, according to the *Chain Store Age*, reflected the effects of the recession in general business. The index that month stood at 110, as compared with 114 in October and 111 a year ago.

Professor Fisher's index of wholesale commodity prices during the week ended Dec. 18 stood at 83.9, as compared with 84.3 the week before and 84.6 two weeks before.

The consolidated statement of the Federal Reserve banks for the week ended Dec. 15 showed a decline of $1,000,000 in holdings of discounted bills. Holdings of bills bought in the open market and Government securities remained unchanged. Money in circulation increased $5,000,000, and the monetary gold stock rose $1,000,000.

Hearing for Auburn

Reorganization Petition Goes To Indiana Court On Jan. 7

January 7, 1938, has been named as the date for a hearing on a petition for reorganization of the Auburn Automobile Co. and the subsidiary Lycoming Manufacturing Co. The hearing will be held in Fort Wayne, Ind., before Federal Judge Thomas W. Slick of the United States district court.

The Auburn company, which has definitely abandoned the manufacture of automobiles, and the Lycoming company filed the petitions for reorganization under section 77B of the amended bankruptcy laws. In the formal statement it was said that the move was "a constructive measure designed to conserve the interests of all stockholders and creditors of the two companies."

The Cord corporation holds 65,124 shares of Auburn stock according to the latest statement on Oct. 31. The Cord corporation also holds 15,000 shares of Lycoming common and 5194 shares of Lycoming preferred.

Motor Fuel Estimate Up 8%

Domestic motor fuel demand for January, 1938, is estimated at 36,500,000 barrels, or eight per cent higher than the apparent demand for January this year, according to a forecast issued by the Bureau of Mines, United States Department of the Interior. Exports are estimated at 3,800,000 barrels.

Statistics of the American Petroleum Institute indicate that gasoline stocks increased about 2,500,000 barrels during November, bringing them to approximately 70,500,000 barrels on Nov. 30, or about 11,700,000 barrels higher than on Nov. 30, 1936.

Tin Consumption Up

Statistics Show 13½% Increase In World Total

An increase of 13½ per cent in world consumption of tin from 159,065 tons in the year ended October, 1936, to 180,528 tons in the year ended October, 1937, is shown by statistics appearing in the December issue of the International Tin Research and Development Council's bulletin published by The Hague Statistical Office.

The increase is attributable to the larger consuming countries with the exception of France where there was a decrease of 7.6 per cent. In the United States tin consumption increased by nearly 15,000 tons or 20½ per cent and other advances occurred in the United Kingdom, about 15 per cent, the U.S.S.R. and Germany, each about 32 per cent, Japan 23 per cent, and Canada 17 per cent.

Will Fight 8-Hr. Day

URWA Opposed To New Work Schedule Rumored Planned

Any attempt by Akron tire manufacturers to reinstate the eight hour day will be "vigorously opposed" by the United Rubber Workers of America, affiliated with the CIO, according to a statement of policy embodied in special resolutions unanimously adopted at a special two-day session of rubber union representatives from Ohio, western Pennsylvania, western New York and western Maryland, which was held in Akron, Dec. 20-21.

The resolution on hours and wages followed reports that attempts might be made to substitute the eight-hour day for the prevailing six-hour day in Akron factories, N. H. Eagle, district organizer, said.

President S. H. Dalrymple of the URWA announced that the union now has chartered 146 local unions with total membership of 79,658. Membership in district which includes the Akron area is reported to be 45,186. Other district figures reported show eastern States 5267 members; Michigan 5208; Mountain district, 10,797; West of the Rocky Mountains 3379; Canada 2842, and others 6567.

Union officials also announced plans for an intensive drive to organize unemployed rubber workers and tire builders.

Indicative of the extent to which rubber and tire manufacturers suffered from the recent collapse in crude rubber prices, which caused

them heavy inventory losses, the Seiberling Rubber Company, of Akron, had a gross profit of $599,897 for its fiscal year which ended Oct. 31, converted into a net deficit of $10,443. Officials claim the loss was due almost entirely to heavy inventory losses on crude rubber. Seiberling sales for the year were $10,546,090—a gain of 20 per cent over the previous year.

Keller Scouts New Model Rumors

In a telegram sent this week to all dealers, K. T. Keller, president of Chrysler Corp., denied reports that Plymouth planned to bring out a new model in January or that price changes would be made on any of the corporation's lines.

The telegram stated, in part, "Some metropolitan newspapers have published a report that Plymouth is bringing out a new model in January. This is unfounded rumor which is untrue. Plymouth cars are selling in very good volume consistent with present business conditions. I can assure you that Chrysler Corp. is not bringing out new models or changing prices on any other of its lines of cars."

Theodore Delavigne

Theodore Delavigne, 47, probably most widely known for his work publicizing Henry Ford's "Peace ship" during the World War, died on Tuesday, Dec. 22. At the time of death he was a member of the staff of the Detroit *Times*.

40 Years Ago

with the ancestors of AUTOMOTIVE INDUSTRIES

Pneumatic Carriage

Some two years ago the Pneumatic Carriage Co. was organized. The first carriage built by the company was completed in November, 1896. It has seating accommodations for six passengers, weighs 2700 lb., and will run 20 miles over ordinary good roads on one charge. A grade of 20 per cent is claimed to be surmountable.

The storage reservoirs have a capacity of 13 cu. ft. of compressed air at 2000 lb. pressure and have a factor of safety of 6½ to 1, the bursting pressure being 13,000 lb. per sq. in.

From *The Horseless Age*, October, 1897.

67 M. P. H.

J. Walter Christie, 70-year old inventor, shown clocking his new army tank at 67 m.p.h. at Westfield airport, N. J. The war machine stands only four feet high and is powered by a 430 hp. Curtiss-Wright aircraft engine.

International News photo

October Truck Output Passed by 111%

Highlight of the statistics for passenger car and truck production for November, 1937, is the approximately 111 per cent jump of the total number of trucks turned out in November as compared with the figure for October. The data also shows a slight increase in passenger car production with November's output topping that of the previous month by 2081 units. Totals for first 11 months' passenger car and truck production this year as compared with 4,097,316 for the same period last year show an increase of about 14 per cent.

Passenger Car and Truck Production (U. S. and Canada)

	November 1937	October 1937	November 1936	Eleven Months 1937	Eleven Months 1936
Passenger Cars—U. S. and Canada:					
Domestic Market—U. S.	269,580	273,753	315,520	3,430,725	3,059,459
Foreign Market—U. S.	25,748	24,909	25,565	240,753	184,704
Canada	13,793	7,378	10,086	138,247	112,412
Total	309,121	306,040	351,171	3,809,725	3,356,575
Trucks—U. S. and Canada:					
Domestic Market—U. S.	48,977	22,595	41,937	638,018	589,934
Foreign Market—U. S.	15,758	8,619	11,965	173,785	121,308
Canada	2,781	725	726	48,101	29,499
Total	67,516	31,939	54,628	859,904	740,741
Total—Domestic Market—U. S.	318,557	296,348	357,457	4,068,743	3,649,393
Total—Foreign Market—U. S.	41,506	33,528	37,530	414,538	306,012
Total—Canada	16,574	8,103	10,812	186,348	141,911
Total—Cars and Trucks—U. S. and Canada	376,637	337,979	405,799	4,669,629	4,097,316

Passenger Car Production by Wholesale Price Classes (U. S. and Canada)

	Eleven Months 1937	Eleven Months 1936	Per Cent Change	Per Cent of Total 1937	Per Cent of Total 1936
Under $500	1,613,593	1,787,117	− 9.6	42.35	53.24
$501 to $750	1,952,749	1,415,033	+38.0	51.26	42.16
$751 to $1000	200,672	105,898	+89.1	5.27	3.15
$1001 to $1500	28,283	34,474	−17.9	.74	1.03
$1501 to $2000	10,625	9,826	+ 8.2	.28	.29
$2001 to $3000	3,534	3,943	−10.5	.09	.12
$3001 and over	269	284	− 5.3	.01	.01
Total	3,809,725	3,356,575	+13.5	100.00	100.00

Truck Production by Capacities (U. S. and Canada)

	Eleven Months 1937	Eleven Months 1936	Per Cent Change	Per Cent of Total 1937	Per Cent of Total 1936
1½ Tons and less	800,770	686,819	+16.5	93.12	92.73
2 to 3 Tons	35,231	36,247	− 2.8	4.10	4.89
3½ Tons and over	12,756	7,793	+63.9	1.48	1.05
Special and buses	11,147	9,882	+12.9	1.30	1.33
Total	859,904	740,741	+16.1	100.00	100.00

Automotive Metal Markets

Increased Automotive Consumption of Stainless Steel Indicated as Chrome Ore Prices Hold Firm

Cheering to steel producers in connection with the outlook for 1938 automotive consumption of steel is the prospect that the steel content per unit, which since the advent of all-steel bodies and tops has appreciably increased, will remain much as it is and that the sway of alloy steels is steadily gaining momentum.

Confidence in the further expansion of automotive consumption of the stainless types of steel is reflected in the latest developments in the ore market, in which chrome displays price firmness in sharp contrast to the general weakness in prices for other ores. While stainless steel now comes in for a multiplicity of uses, consumption in automobiles, as for instance in radiator grille assemblies, furnishes the tonnage market.

In the steel market, where there were again voiced fears this week that some automobile manufacturers would press for lower prices, sight is so often lost of the fact that base prices are after all only an ingredient in the automobile manufacturer's steel bill, in which differentials and extras play a much more important role than is the case with most other industrial users. Leading steel producers complain bitterly that governmental interference has taken control over costs out of their hands and that, therefore, they are unable to adjust their prices to conditions, but news regarding this week's developments in the Steel Workers' Organizing Committee's deliberations makes the outlook for a more conciliatory tone, when contracts with the steel companies come up for renewal in February, somewhat brighter.

Important in this connection is the permanent shutting down of additional rolling mill units that became obsolescent with the coming in of automatic continuous mills, but that had been intermittently operated during peak periods of demand.

While the aluminum market is marking time, preparations are going forward to intensify sales efforts in the automotive field by way of coordinating activities with the industry's engineering forces, which are making special studies to broaden the market for the metal in its use for cylinder heads (see AUTOMOTIVE INDUSTRIES, issue of Dec. 18, p. 859).

Recessions in foreign market prices have resulted in the lowering of cadmium prices, one producer having announced a reduction from $1.60 to $1.25 per lb.

Custom smelters cut the price of electrolytic copper to 10⅛ cents in the hope of "smoking out" some of the business that was said to be overhanging the market in the event of 10-cent copper being chalked up. Whether it was the ⅛ cent difference between their asking price and that which "investment" buyers had in mind or whether there just wasn't any demand at any price, commitments were few and far between. Large mine producers adhered to their 11-cent quotation. Foreign demand made a fair showing with the "export" price early in the week hovering around 10⅛ cents. The old-time axiom that copper consumers buy only in a rising market, appears still to hold good.

Tin staged a dull performance on the first two days of the week, spot Straits being barely steady on Tuesday at 42 cents. Late last week some business had been done at 43½ cents. The trade seems to have reached the definite conclusion that the cut in exports by the International Tin Committee will still leave available more tin than consumption in sight calls for.

Lead and zinc steadied, following price reductions late last week. The price of lead has been reduced seven times since the beginning of August, each cut lowering the price $5 a ton.

—W. C. H.

Scores Finance Probe Dismissal

Federal Judge Geiger's Grand Jury Ouster Ruling Draws Fire From Attorney General Cummings

Federal Judge Ferdinand A. Geiger's dismissal last week of the Milwaukee grand jury's probe of finance company relations with automobile manufacturers brought sharp criticism from U. S. Attorney General Homer S. Cummings. The Attorney General condemned the action in a letter addressed to Representative Summers, chairman of the House Judiciary Committee.

Companies involved were Ford, Chrysler, and General Motors; also, the Commercial Investment Trust, its affiliate, the Universal Credit Corp., the General Motors Acceptance Corp., and the Commercial Credit Co.

The judge explained his action on the ground that certain conferences between attorneys for the firms under fire and department of justice officials at Washington looking forward to a consent decree impaired the sanctity of the jury proceedings.

Immediately following the jury ouster ruling, Russell Hardy, chief Government prosecutor, asserted that indictments charging violations of the Sherman anti-trust laws had already been voted.

To the prosecutor's claim that a consent decree banning illegal practices in the future would not bar prosecution for the specific offenses charged, Judge Geiger stated:

"It is my judgment that the department of justice did not have power to negotiate for a consent decree. There are limits to what can be done with subject matter pending before a grand jury. It was improper for these parties to get together and talk of a 'deal' on such a subject. The court has no recourse but to discharge the jury."

The allegedly illegal practices under Federal scrutiny included: Discrimination against independent finance companies, coercion of dealers into doing business with the affiliated finance companies, and splitting of finance charges between credit firms and dealers.

Casing Shipments Off 16.7%

Estimates of shipments of pneumatic casings in the third quarter of 1937 at 13,590,949 units, indicate a decrease of 16.7 per cent under shipments made during the second quarter of this year, and 6.6 per cent under shipments made during the third quarter of 1936, according to a report issued by the Rubber Manufacturers Association.

Production of pneumatic casings for the third quarter decreased 22.9 per cent from the second quarter and 18.2 per cent from the third quarter of 1936.

Evans Products Omits Dividend

At a regular meeting of the board of directors of the Evans Products Co. this week it was decided, due to business uncertainties, to omit the dividend usually payable at this time.

Rubber Imports Up

November Data Show 7.2% Gain: Consumption Falls 12.2%

Consumption of crude rubber by United States' manufacturers during November is estimated to be 33,984 long tons, according to statistics released by the Rubber Manufacturers Association. Compared with 38,707 long tons consumed during October, the November figure is 12.2 per cent down. The estimated total for November is also under the revised figure of 50,433 long tons consumed in November, 1936.

Gross imports of crude rubber for November are reported by the association to be 56,302 long tons, an increase of 7.2 per cent over the October figure of 52,508 long tons and 27.1 per cent over the 44,296 long tons imported in November last year.

Total domestic stocks of crude rubber on hand Nov. 30 are estimated at 217,586 long tons. This shows an increase as compared with Oct. 31 stocks of 195,685 long tons and 211,480 (revised) long tons on hand Nov. 30, 1936.

November reclaimed rubber consumption is estimated at 9703 long tons, production 12,406 long tons, and stocks on hand Nov. 30, 24,620 long tons.

Transit Convention Date Set

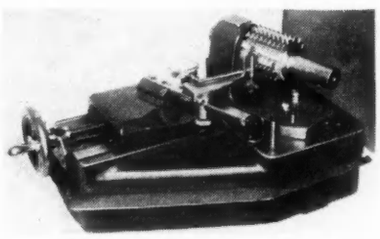
The fifty-seventh annual convention of the American Transit Association is scheduled to take place in the Atlantic City auditorium, New Jersey, Sept. 19 to Sept. 22, 1938. An exhibit held by the manufacture members of the association will open Sept. 17 and continue through to the close of the convention.

The exhibit will include a showing of buses, trolley coaches, rail cars, and other transit equipment, including shop and maintenance tools and accessory equipment, and parts and appurtenances used in the operation and maintenance of urban and interurban transportation systems.

Gar Wood to Show at Cleveland

A representative line of motor truck equipment and road machinery will be exhibited by Gar Wood Industries, Inc., Detroit, at the 1938 Road Show of the American Road Builders' Association, to be held at Cleveland Jan. 17 to Jan 21, according to Logan Wood, vice-president and general manager.

TOOLS OF TOMORROW



Improved hob contour checker

Hob Contour Checker

. . . Michigan Tool Co. improves device for toolroom and gear laboratory use

An improved design of hob contour checker for toolroom and gear laboratory use has been developed by the Michigan Tool Co., Detroit. It is designed for checking hobs in locating possible sources of gear errors in gear analysis work.

The instrument shows any deviation from true pressure angle down to 0.0001 in. A feature of the device is that it does not require interchangeable angle blocks for checking hobs of different pressure angles. To accommodate different pressure angles, a sine-bar setting is provided on the checker.

The indicator is provided with a multiplication of five to one, so that a movement of the contact finger of 0.0002 in. will register a travel normally representing 0.001 in. on the indicator. This enables registering such depressions and elevations as are caused by rough grinding.

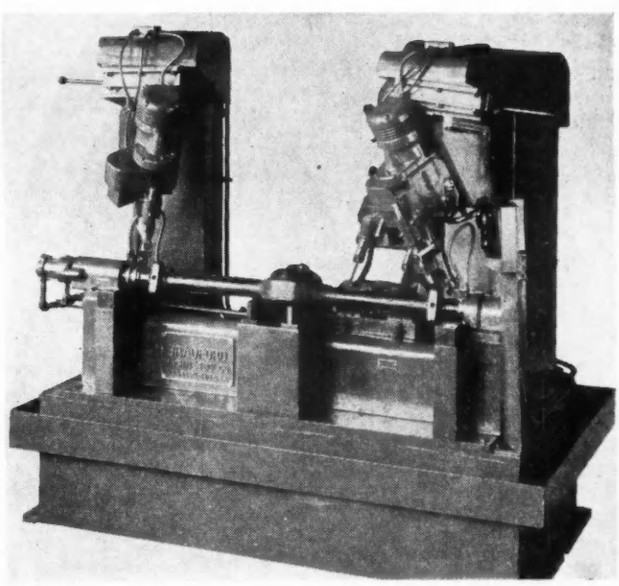
Rear Axle Housings

. . . production problem simplified by Bradford automatic drilling machine

Drilling and chamfering several angular holes in automobile rear axle housings is accomplished on the automatic machine pictured herewith, built recently by the Bradford Machine Tool Co., Cincinnati, Ohio. Due to the bulky shape of the work and the compound angles of the holes, drilling of these housings formerly represented an involved production problem requiring several machines, operators, and set-ups to handle the work accomplished by this machine with one operator.

Constructed almost entirely of welded steel, the machine consists essentially of a box type base supporting a work holding fixture and four Bradford automatic units, suitably mounted for the required operations. The two units mounted on the columns at each end of the equipment have a quick acting cam type adjustment for taking care of varying lengths of housings. The fixture locates and holds the hous-

(Turn to page 897, please)



Bradford automatic machine for drilling and chamfering holes in rear axle housings

AUTOMOTIVE ABSTRACTS

Inverted Vee Aero Engine

A new 12-cylinder inverted Vee aircraft engine, the Jumo 210, has been placed in production by the Junkers Works of Dessau, Germany. This engine was used on some of the planes participating in the Zurich flying competition, where it showed up to advantage. It differs completely from previous Junkers aircraft engines, all of which have been of the vertical in-line type.

As in aircraft work it is desirable to have a minimum frontal area, the massive parts of the 210 were made as compact as possible, and it is claimed that an almost ideal form was obtained as regards both width and length. The frontal area of the engine is so small that it disappears almost completely behind the hub of the three-bladed, variable-pitch propeller.

The engine is of the water-cooled type and has two banks of cylinders making an angle of 60 deg. with each other. It has a displacement of 1200 cu. in. and its rating is 680 hp. at ground level, and 640 hp. in flight at 2700 r.p.m. There are two inlet ports and one exhaust port per cylinder. Valves are actuated from the camshaft through rocker levers. The crankcase is of light alloy, and light alloy pistons are used. The crankshaft is supported in eight bearings. It turns left-handedly when looked at in the direction of flight, while the geared-down propeller turns right-handedly. A Sum carburetor is fitted, and the engine is designed to use 87 octane gasoline. It weighs 975 lb. and has the following overall dimensions: Length, 58 in.; height, 37.8 in.; width, 27 in.

Cost of British Cars

In a very readable paper on "The Effect of National Conditions on Automobile Design in Great Britain," read before the Institution of Automobile Engineers by Maurice Platt of the Vauxhall engineering department, he discusses the interesting question as to why passenger cars cost almost twice as much in Great Britain as in the United States. Says Mr. Platt:

"Discounting the fact that many of the 'list prices' in the U. S. are misleading, because they are subject to the addition of various 'extras' (which are theoretically optional, but are actually mandatory), there remains a price ratio of nearly 2 to 1 when the popular cars of the two countries are compared upon a 'pence per lb.-weight' basis. To our protected home market, and in such markets overseas as discriminate (at present) in favour of the British car, this question is not yet urgent, but it is fundamental to any real increase in our export trade.

"The answer seems best summed up in the fact that, apart from labour and marketing expenses, 'everything costs more' in this country—steel, glass, paint, forgings, components, etc. These and other factors all affect the price for which a car can be sold at a profit. The relatively high price paid for such supplies may bear some relation to the fact that associations exist for the protection of various groups of manufacturers, although a searching enquiry would be needed to establish the precise effect of such organisations. All automobile engineers have a direct interest in the problem, inasmuch as they are continually labouring to produce betters cars for less money, and also because their livelihood depends upon the prosperity of the industry which they serve."—*Journal of the Institution of Automobile Engineers for December.*

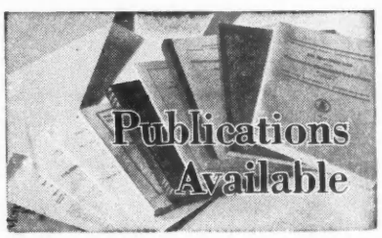
Transmission Developments

In a paper on "Transmission Gear Developments and the Possibilities of Simplified Controls," read before the Institution of Automobile Engineers by L. J. Shorter, chief engineer of Singer Motors, Ltd., the author reviews the improvements in transmission gears since 1921, such as the use of helical and herringbone gear teeth, improved methods of gear-tooth finishing, lower tooth pressures, stiffer shafts with improved mountings, more accurate machining, better inspection and testing, improved methods of transmission mounting, etc.

Looking into the future of transmission development the author sees the following: Synchromesh with the possible addition of pre-selection will survive for some time; three speeds will be more favored than four, owing to silent changes being possible with wider ratio differences; over-drive, or indirect top gear, will not appear, owing to added weight and cost; the centrifugal clutch should find increasing use, owing to its automatic action, which obviates the use of the clutch pedal in traffic; the usual change-speed and hand-brake levers will disappear from the center of the front compartment; the planetary gear will increase in use only when it can be made simpler, lighter and less expensive; simplified and more nearly standardized controls should eventually mature, but the process may be gradual and transitional, as breaking tradition is sometimes a long and difficult process, unless the change is an imperative necessity or a financial economy.

The foregoing predictions, of course, have reference to the future of transmission practice in Great Britain only and do not apply in this country. For instance the majority of the cars in service in Great Britain have engines of less than 100 cu. in displacement, and with such small engines geared to give a satisfactory top speed, the overdrive certainly does not offer any particular advantage.

The complete paper is printed in the December issue of the *Journal of the Institution of Automobile Engineers.*



A new bulletin on **"Sheffield Gages"** has been published by the Sheffield Gage Corp., Dayton, Ohio.

Carboloy Co., Inc., Detroit, has issued a 12-page Die Service Manual which illustrates and describes the manufacturing technique necessary to bring **Carboloy** "rough cored" and "blank" dies up to the finished state. A new price list has also been prepared.*

A **"Symposium on Corrosion Testing Procedures"** has been published by the American Society for Testing Materials, Philadelphia, Pa. The 131 pages in this brochure contain seven technical papers and related discussion presented at the 1937 regional and annual meetings of the A.S.T.M. Copies are available at $1.25 each.

Compression characteristics of a **neoprene** stock and a similar rubber stock are discussed in a new pamphlet brought out by E. I. du Pont de Nemours & Co., Inc., Wilmington, Del.*

Journal-bearing design as related to maximum loads, speeds and operating temperatures is treated by Samuel A. McKee in research paper RP 1037 issued by the National Bureau of Standards. It may be obtained for the price of 5 cents from the

Superintendent of Documents, Washington, D. C.

A report of the **research and extension activities of engineering schools** and departments has been issued by the Engineering Experiment Station, Lafayette, Ind., and is designated as No. 57 in a research series.

Gallonage tables for horizontal cylindrical tanks with flat ends will be found in circular C 416 issued by the National Bureau of Standards. Copies are available at 10 cents each from the Superintendent of Documents, Washington, D. C.

The triple-control method, trade-named Vapocarb-Hump, for **heat treatment of steel** is described in a 36-page catalog just issued by the Leeds and Northrup Co., Philadelphia, Pa.*

Latest piece of equipment built by The Geometric Tool Co., New Haven, Conn., known as the No. 14 **threading machine**, is described in a new bulletin issued by that company.*

*Obtainable from editorial department, AUTOMOTIVE INDUSTRIES. Address Chestnut and 56th Sts., Philadelphia.

Bosch President Resigns

Arthur T. Murray has resigned the presidency of United American Bosch Corp., effective Dec. 31, this year. Mr. Murray will become associated with the Moore Drop Forging Co. and continue as a director and member of the executive committee of United American Bosch Corp.

Chevrolet Sponsors Truck Week

Backed by an extensive advertising campaign, 9600 Chevrolet dealers will take part in a company-sponsored national truck week scheduled to begin Jan. 10, 1938, according to W. E. Fish, Chevrolet commercial car manager.

The program calls for newspaper advertising, supported by radio, billboards, and direct mail material. The five Chevrolet 1938 truck models include: two models for light delivery on the "Master" passenger car chassis and a number of different models on the heavier ½-ton, ¾-ton, and 1½-ton chassis. The 1½-ton models are available on both the 131½-in. wheelbase and the 157-in. wheelbase.

Tools of Tomorrow

(Continued from page 895)

ings by plugs on each end which are adjustable and removable for adapting the fixture to other sizes of housings. A built-in coolant system is incorporated in the base, including a ball bearing, motor driven pump, coolant reservoir and coolant channels.

Control and synchronization are accomplished electrically through built-in limit switches, relays, and auxiliary equipment. Automatic clamping and unclamping of the fixture is accomplished by compressed air regulated by an automatic valve on the master drilling unit.

Work of the operator consists only of placing the work into this fixture and removing it when drilled. A pilot light in front of the operator notifies him when the machining cycle has been completed and the part is ready for removal from the fixture.

Net production of the machine on steel housings is said to be 70 per hour.

Favor Marine Act Revision

Revision of the Merchant Marine Act of 1936 to include ocean-going aircraft as "vessels"—a step urged by Chairman Joseph P. Kennedy of the Maritime Commission—is gaining in favor among aircraft manufacturers.

Edgar N. Gott, vice-president of the Consolidated Aircraft Corp., San Diego, Calif., told the Senate Interstate Commerce Committee on Dec. 16 that trans-oceanic air commerce should be placed under the jurisdiction of the Maritime Commission.

Gott testified during hearings on the Copeland bill which incorporates most of the recommendations made by Chairman Kennedy in his report to Congress last month.

Calendar of Coming Events

Foreign Shows

Peru, Automobile Show, Lima, Dec. 23-Jan. 6, 1938

Leipzig, Trade Fair, March 6 to 14, 1938

Conventions and Meetings

American Engineering Council, Annual Meeting, Washington, D. C. .....Jan. 13-15, 1938

SAE Annual Meeting, Detroit, Jan. 10-14, 1938

American Road Builders' Association, Cleveland, Jan. 17-21, 1938

American Society for Testing Materials, Spring Regional Meeting, Rochester, N. Y. March 7, 1938

SAE National Aeronautic Meeting, Washington, D. C. March 10-11, 1938

SAE National Passenger Car Meeting, Detroit, March 28-30, 1938

Willys Assets Increase

Statement Shows Net of $679,029 For Fiscal Year Ended Sept. 30

Willys-Overland Motors, Inc., has reported net earnings of $679,028.99 for the fiscal year ended Sept. 30, before provisions for Federal taxes on normal incomes, excess profits and surtax on undistributed profits.

According to the company's annual statement mailed to stockholders, Willys-Overland increased its assets during that period to $17,055,418.81. Current assets at the end of the fiscal year totaled $6,110,264.49, a ratio of two and one-third to one over current liabilities, with a working capital of $3,482,729.57.

After deducting Federal taxes on income, excess profit and undistributed profit, the net earnings amounted to $473,028.99. This result is after absorbing a loss of $395,630.13 in the first period ending Dec. 31, 1936, which was incurred due to initial months of non-production following incorporation and non-recurring initial expenditures entailed in starting up plant operations.

Depreciation and amortization in the amount of $1,023,022.57 has been charged to cost of sales and expenses.

Company taxes for the year aggregated $528,616.04, including all Federal, State and county, with the exception of Federal excise tax, which is collected from purchasers through distributors.

Cash dividends at the rate of 6 per cent per annum on the $10 par value convertible preferred stock amounted to $186,706.78, and $286,322.21 was carried to surplus.

Capital structure of the company consists of 320,778 shares of 6 per cent cumulative, convertible preferred stock of $10 par value, and 2,046,229 shares of common stock of $1 par value. A capital surplus of $8,887,552.68, to which is added $286,322.21 earned during the fiscal year, gives the company a total capital and surplus of $14,427,883.89.

Olds Total Sales Up 9 Per Cent

Total retail sales of Oldsmobile cars for the period Jan. 1 to Dec. 10 amounted to 181,511 units, a gain of nine per cent over the same period in 1936.

Retail sales of 1938 Oldsmobiles for the first 10 days of December totaled 3090 units, according to D. E. Ralston, general sales manager.

Seed of Dissension

By LEO WOLMAN*

WE have been carrying on a large experiment in labor policy. Although it is only four years old, its main features are familiar to everyone. Many employers and their workmen have already had experience with it. In addition to a great wave of strikes, interrupted only by the present decline in business, employers and their workmen have been involved in a growing mass of litigation over discharges, the forms of negotiation, the meaning of collective bargaining, and the uses of contracts between employers and unions.

Tens of thousands of workmen in all parts of this country have trooped to the polls, where it is assumed they will be free from all unfair influence and pressure, to record their preferences and to make their choice of bargaining representatives. The determination of election districts and the eligibility of voters, as well as the time and circumstance of an election, all crucial factors in the results of any poll, have been involved in the strategy and tactics of organizing campaigns, and during the last twelve months in the conflicting claims and political pressures of the two warring factions in the American labor movement, the C.I.O. and the A. F. of L. The majority rule, as defined in the law and as applied by the law's administrators, has taken on the sanctity of an eternal principle of politics and ethics, and as such has become immune to all question and criticism.

This policy, whatever its virtues, has not yet contributed to peace in industry. The volume of unrest has failed to subside. Many people believe, and there is much in the record to support their opinion, that our labor policy itself, and not the conditions of employment, has been the prolific source of strife and conflict. In many of our industrial centers, and certainly in most of our large cities, the streets continue to be lined with pickets, individual and mass, professional and amateur, strikers and outsiders. The area of picketing has spread so that it now covers the persuasion or intimidation not alone of those who remain at work in struck plants, but also of customers and advertisers. To the simple strike has been added the boycott, primary and secondary. Following a period of exceptional advances in wages and reductions in the hours of work, such as American labor has had since 1933, it seems strange that peace is still so far away and that industrial warfare yields not to the good offices of public agencies of conciliation, but only temporarily to the forces of depression and unemployment.

Issues Easy of Adjustment

The issues which are now considered to divide capital and labor in this country are certainly not so difficult as to defy peaceful adjustment by accepted and tried methods of reason and negotiation. Why, then this growing area of conflict and litigation? What is there in the past history of the policy of industry toward labor or in industry's plans for the future that may be truly regarded as the source of this current disagreement and strife? It is hard to believe that the traditional issues of wages, hours, work rules, representation, and even union recognition have on their own account recently become more difficult and more stubborn than they used to be. But if they are not, what is the trouble? In my judgment, it is to be found in the law now governing labor relations in this country, in the atmosphere in which this law is being applied, and in the philosophy which is coming more and more to dominate prevailing conceptions of what proper relations between employer and employe in this country should be.

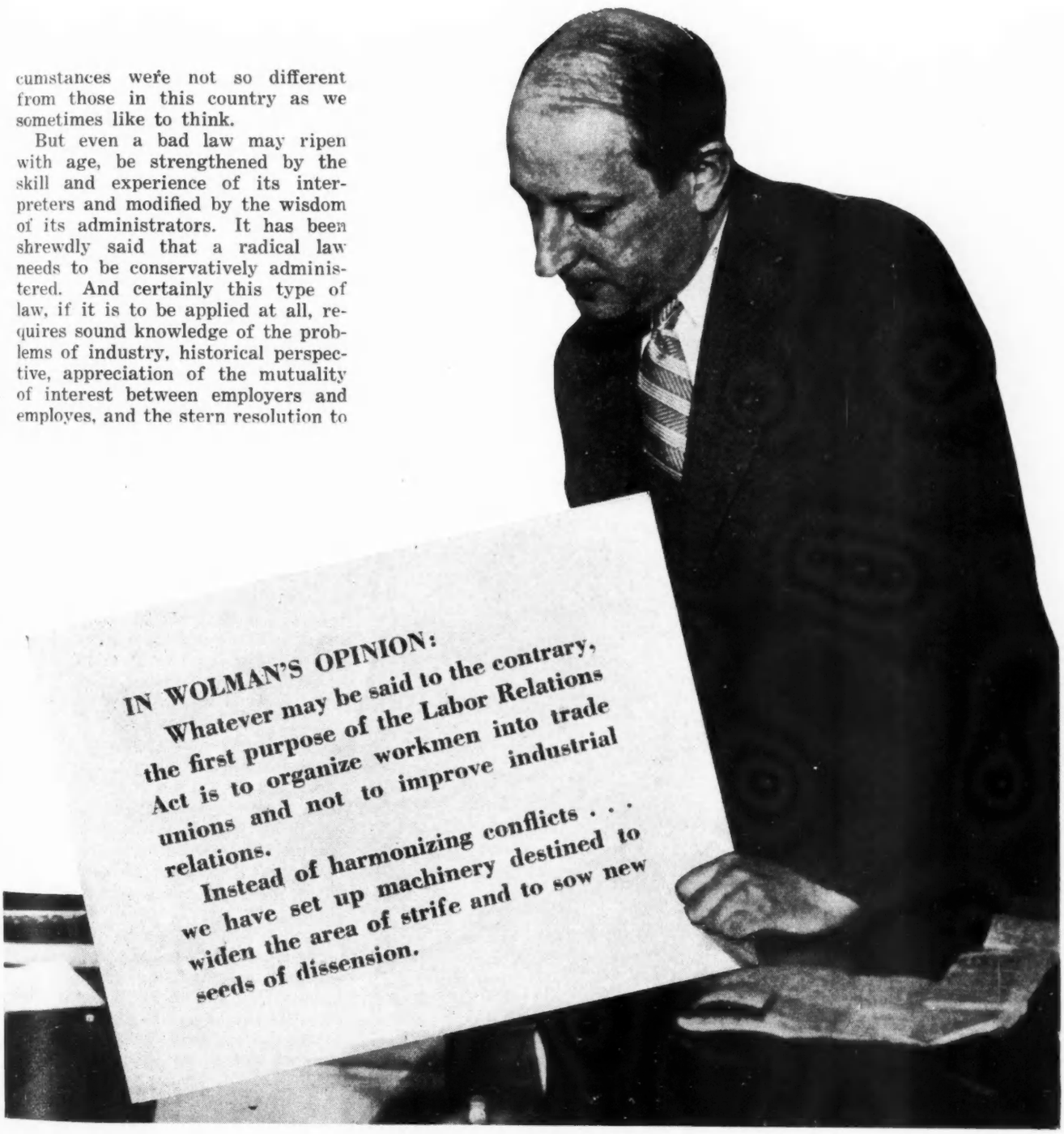
About the law itself not much need be said. From the very beginning I have regarded the federal Labor Relations Act as an unwise, unsound, and unnecessary piece of legislation. Nothing in the history of the administration of this law has caused me to change my mind about this. In its terms it is calculated to create and not to allay unrest. Whatever may be said to the contrary, the first purpose of the law is to organize workmen into trade unions and not to improve industrial relations. To the extent that this is true, the government and its agencies become organizers of unions, whether or not they wish to perform this function. The majority rule, as stated in the law and applied in practice, is a double-edged weapon aimed, on the one hand, to drive minorities, large or small, into the union and, on the other, to disfranchise such minorities as succeed in retaining their identity and preserving their rights. The economic assumptions on which the law rests cannot be made effective without the progressive cartelization or monopolization of industry, thoroughgoing control over prices and output, and finally the fixing of wages and the regulation of all of the activities of unions. When and if this comes to pass, much of the current talk about free collective bargaining will be seen to be so much idle chatter, which, indeed, it has already become in several countries of Europe, where the antecedent cir-

* Full text of address delivered before the National Association of Manufacturers, in New York, Dec. 9.

found in present government machinery for handling labor relations by chairman of former Automobile Labor Board, who breaks long silence to disclose his appraisal

cumstances were not so different from those in this country as we sometimes like to think.

But even a bad law may ripen with age, be strengthened by the skill and experience of its interpreters and modified by the wisdom of its administrators. It has been shrewdly said that a radical law needs to be conservatively administered. And certainly this type of law, if it is to be applied at all, requires sound knowledge of the problems of industry, historical perspective, appreciation of the mutuality of interest between employers and employes, and the stern resolution to


IN WOLMAN'S OPINION:
Whatever may be said to the contrary, the first purpose of the Labor Relations Act is to organize workmen into trade unions and not to improve industrial relations.
Instead of harmonizing conflicts . . . we have set up machinery destined to widen the area of strife and to sow new seeds of dissension.

be scrupulously objective and impartial.

What a law like the Wagner Act means in practice depends as much on the atmosphere surrounding its application as on the specific meaning of its terms. In the last several years we have seen and heard enough to know what this atmosphere is. It is full of suspicion and distrust of industry. It neglects, if indeed it concedes the existence of, any positive and constructive contributions by employers to the improvement of human relations in industry. It denies the existence of an essential harmony and mutuality of interest between capital and labor. The exceptional advances in American working conditions and in methods of industrial relations, which certainly compare more than favorably with like conditions anywhere else in this world, are minimized in favor of a narrow and probably fallacious conception of the sources of high wages, short hours, and good working conditions. The contribution to labor conditions of the powerful forces of competition, bringing into cooperative use capital, scientific invention, skilled and productive labor, and the creative functions of management, is sacrificed to a policy of price-fixing and uniform wage-rates, bound in the long run to increase the total volume of unemployment and to make an increasing segment of the American population permanent and unhappy wards of the State. And, finally, it confuses ends with means, condones force when used for one purpose, condemns it for another, and thus builds the foundation for deep-seated resentment and conflict in the near future.

The Spirit of Interpretation

This is not the time to subject the decisions made under the Wagner Act to the analysis they deserve. But something of the spirit in which the law is interpreted can be gleaned from the opinions, from time to time, freely expressed, of high public officials charged with its administration.

The assistant general counsel of the National Labor Relations Board addressed the New York Women's Trade Union League on the subject of union responsibility[1]. "With this proposal (to make unions responsible)," he said, "you are all familiar. It is that the Act be amended to provide that in the exercise of their right to self-organization employes should be free from interference, restraint, and coercion 'from any source.' You opposed this amendment when the Wagner bill was before Congress, and it was defeated. It is before Congress again, and will be considered when Congress resumes its sessions. I want to discuss with you the implications of this proposal in terms of the administration of the Act, and in doing so will not review in any detail the familiar arguments against the amendment. These can be summarized shortly. The amendment rests on the assumption that organized labor is guilty of coercion on a large scale. This assumption is yet to be proved. It rests on the further assumption that the courts and local law enforcement agencies cannot cope with coercion by labor. This assumption, too, remains to be proved. Furthermore, the amendment exhibits a profound confusion in assimilating the meaning of 'coercion' as practiced by the employer simply by virtue of his superior economic position, with the meaning it has when applied to the activities of trade unions. Despite the confusion on the subject, there can be no mistake as to what 'coercion' means when it is practiced by the employer. His duty is to keep hands off the organizational activities of the workers; if he fails in any respect it is 'coercion.' But 'coercion' by unions means something vastly different; the law encourages the activities of their members. Yet the courts have held that a threat to strike is 'coercion'; courts have denounced peaceful picketing as 'coercion'; and one court has gone so far as to find intimidation in the very silence of a single picket. Is the National Labor Relations Board expected to prevent these activities? Finally, and even if 'coercion' is taken to mean violence, and nothing more, the amendment would transform the board into a vast enforcement agency the like of which this country has never seen."

The chairman of the board has frequently complained of the helplessness of individual American workmen. In a speech before the United States Conference of Mayors[2] he said:

"Every informed person knows that the individual workman is helpless, so far as having any control over his wages, hours, conditions of employment and the security of his job is concerned.

"This is said with full recognition of the fact that there are many employers who out of benevolence or enlightened self-interest may voluntarily give to their employes advantages approximating those which could be gained by organization and equal bargaining. But such employes are just as helpless and economically dependent as are those of the worst type of employer. You have, no doubt, frequently heard it said: 'Why does the union bother the X company? It treats its men the best of any employer in the community. Why doesn't the union limit its activities to Y and Z who are bad employers?' I have no doubt that in the days of human slavery, many slaves were treated better by their owners than they were treated by the world after they were given their freedom. But that was never regarded as a reason for freeing only the slaves of vicious masters, and leaving those of benevolent masters in slavery. There can be no question about the right of unions to organize the employes of benevolent employers, nor of the right of such employes to join unions if they choose."

The Obligation is Hands-Off

And at the Annual National Business Conference of Babson's Institute, a member of the board said[3]:

"Turning now to certain considerations regarding the Act itself, apart from its administration. The Act is in nowise complicated in its provisions. The employer's obligations under it are of the simplest. He is required only to keep his hands off entirely from his workers' efforts at organization for their collective protection and economic advancement. The only reason that employers run into difficulty in following this simple prescription is that the itch to interfere with their employes' self-organization is apparently so great that many of them simply cannot restrain themselves. If they do not resort to such drastic steps as discriminatory discharge, they will by word and deed in many instances discourage affiliation with a particular union and encourage affiliation with another. Properly the board has always held that not much in the way of emphasis is necessary to bring an anti-union animus of the employer within the scope of the statutory inhibitions."

These few quotations should give you at least the flavor of the assumptions and state of mind in which one of our most important law-enforcement agencies does its work. Members and agents of the board keep reiterating that it is none of the

[1] Release, National Labor Relations Board, Oct. 2, 1937.

[2] Nov. 16, 1937.

[3] Oct. 6, 1937.

employer's business what his employes think or do about their relations with him. This is at best a curious and unreal doctrine. But when it is applied to a relationship that presupposes a close identity of interest, such as inevitably exists in American business and without which the high productivity of our industry would be impossible to sustain, it is hard to see how adherence to this view of the place of employer in labor relations can promote the democracy in industry, which is the professed goal of our present law and policy. As long as these prohibitions on employers prevail, even secret elections, conducted under Government auspices, will fail to record the free and mature conclusions of American workmen. For as a recent writer in the *Christian Century* puts it[1]:

Vote on Exaggerated Claims

"On what basis does a worker make his decision when he is casting his vote for his choice for bargaining representative? What is in his mind? What facts has he received to weigh? What has he been promised by the union organizer? Mr. Madden, in his Labor Day discussion, pointed out that the claims of union organizers are sometimes as exaggerated as those of politicians; but, he added, the 'cure' is in the secret ballot. The secret ballot is certainly a preventive of gross intimidation. A secret ballot certainly expresses the voter's decision. But what has the secrecy of the ballot to do with the validity of the facts and ideas which may have determined the decision? What is the significance of a secret ballot in a totalitarian state?

"Where does a voter in an industrial election get his facts? The Wagner Act says that 'it shall be an unfair labor practice for an employer to interfere with, restrain, or coerce employes in the exercise of the rights . . . to self-organization, to form, join or assist labor organizations, to b a r g a i n collectively through representatives of their own choosing, and to engage in concerted activities, for the purpose of collective bargaining or other mutual aid or protection.' The National Labor Relations Board's official form, which an employer has to sign in agreeing to an election of representatives, says 'the employer agrees not to interfere by coercion or persuasion directly or by his agents or foremen, with his employes' free choice of collective bargaining representatives.'

"Let us be deaf to all the discussion of the law's one-sidedness and unfairness to employers. Let us agree that all employers are, by definition, incurably vicious and antisocial exploiters and oppressors who cannot do anything decent or honest. Let us agree that the organizers for all unions are, by definition, champions of the oppressed, honest, intelligent, pure in thought and deed and accurate and sincere in everything they say, including everything they say about one another. These statements may be absolute and incontrovertible truths, but what happens to free speech and civil liberties if one person is not permitted to attempt to persuade another by legal means?

"In education for democracy, what is the pedagogical effect of denying one of the elementary principles of our democracy? If it happens that one of the pupils has heard of free speech, what respect will he have for it if he is told that his employer or foreman is violating the law if he tries to communicate with him? Is the union argument so weak that it is unsafe to subject it to any debate?"

As one looks back over the developments in our labor policy since the NRA and the first National Labor Board, created in the autumn of 1933, one cannot fail to be impressed by the great distance we have already traveled away from cooperative relations between employers and workmen in industry. Instead of harmonizing the conflicts of interest that exist in all human relations, we have set up machinery destined to widen the area of strife and to sow new seeds of dissension. In attempting to compose quarrels in industry, we have replaced common sense with rules of procedure, literally and inflexibly applied; knowledge and experience with rigid and untested doctrine. Government, in this country, the traditional arbiter of issues that from time to time divide its citizens, has itself on occasion become a party to the fray and has thereby threatened to impair its influence for peace in the future. However lofty our purposes, however strong our impulse to reform, it cannot be that we must continue along this troubled path and that we will not employ our resourcefulness and powers of invention to devise peaceful means for preventing the victimization of both workmen and employers, organized and unorganized employes, while at the same time ensuring the vigor and continuity of that industry which is the source of livelihood for us all.

[1] Pelham Barr, "Is Labor Learning Democracy," The Christian Century, Oct. 13, 1937.

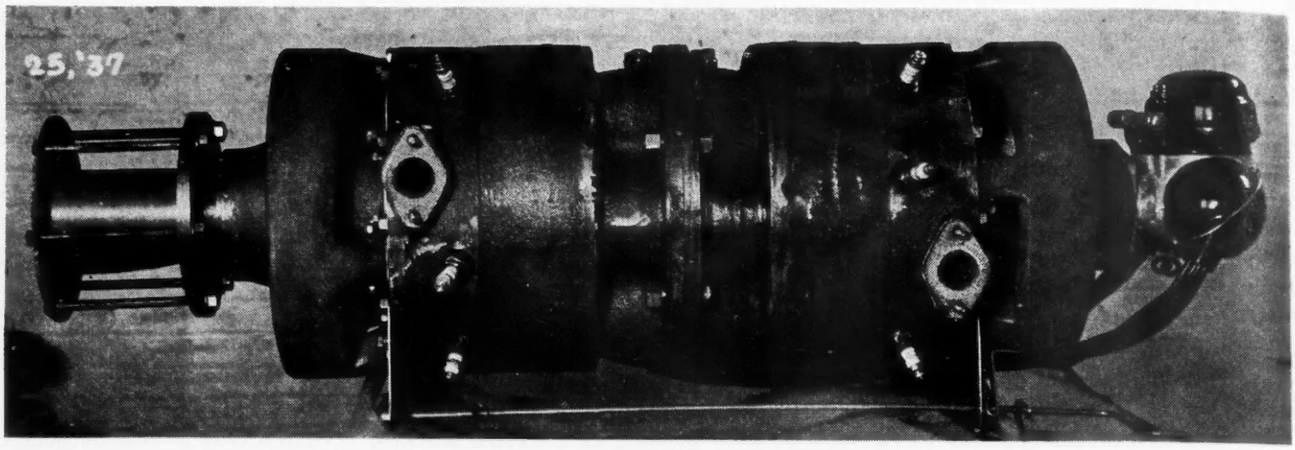
Bearing Material Research

When a bearing is properly designed and under suitable operating conditions, the characteristics of the bearing metal are of minor importance in securing satisfactory performance, since the moving parts are supported by a film of oil. At best, however, this oil film is thin, and under adverse conditions it is reduced to the point where there is metallic contact between the surfaces of the bearing and journal. Under these conditions the characteristics of the bearing metal are a governing factor. Among the requirements significant in the choice of a bearing metal are mechanical strength, resistance to deterioration at operating temperatures, resistance to wear, low friction, and ability to be "run in" (become smoother with use).

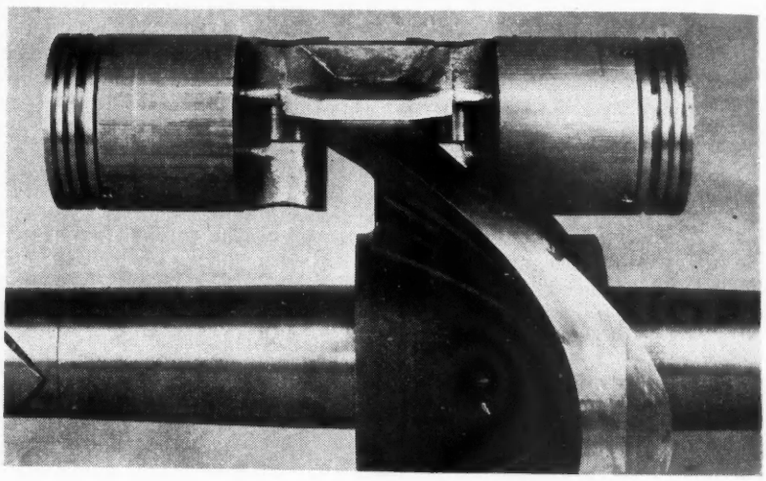
In a paper to be published in the Transactions of the American Society of Mechanical Engineers, S. A. McKee and T. R. McKee of the National Bureau of Standards describe an investigation of the running-in characteristics of journal bearings lined with three kinds of white-metal alloys. A four-bearing friction machine was used to determine the effect of progressive amounts of running in upon the frictional characteristics of the bearings. The results are compared with those of previous investigations, and all are in agreement in providing an indication that the major effect of running in is to reduce the friction losses under severe operating conditions and to increase the permissible operating range. The results also give a comparison of the frictional and running-in characteristics of the various metals.

South Africa Favors U.S. Cars

Of the 3329 motor vehicles newly registered in the Union of South Africa in June last, 2819 came from the United States and 320 from Great Britain. Great Britain, on the other hand, has a firm hold on the motorcycle market of the Union, 156 of the 167 motorcycles registered during the month having been of British origin.



General view of Herrmann barrel-type engine

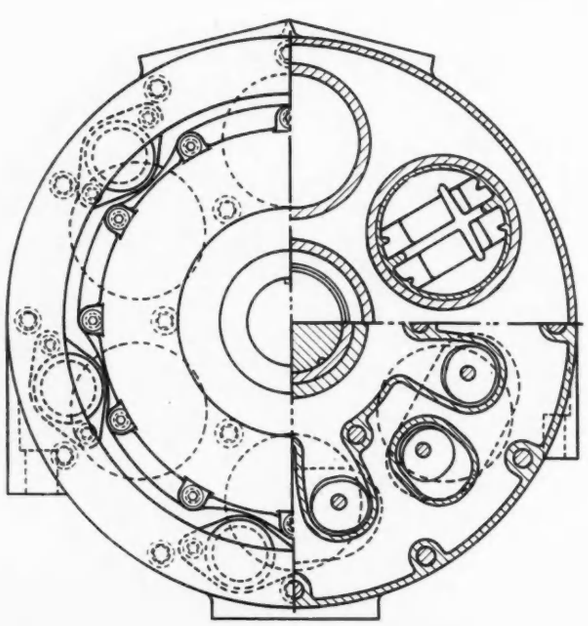


Close up of the cam plate and double piston

Herrmann

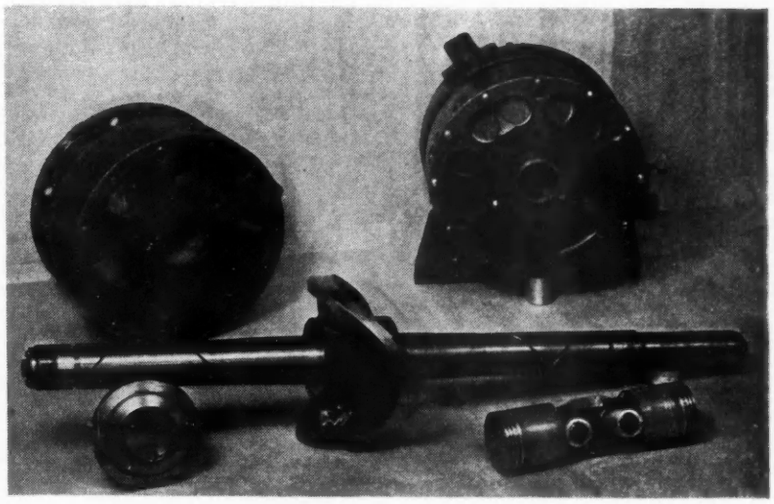
A BARREL-TYPE of internal combustion engine in which the crankshaft is replaced by a cam plate which imparts a simple harmonic motion to the reciprocating parts, has been developed by K. L. Herrmann, South Bend, Ind. Several photographs of a model engine built in accordance with his designs, and of its major parts, are reproduced herewith.

One of the most attractive features of the barrel-type engine is its compactness, and the engine lends itself particularly to use in aircraft, because of its relatively small frontal area. Of course, compactness and low weight are desirable also in automobile applications, particularly with certain chassis types with which the space available for the powerplant is restricted, such as front-drive and rear-engined passenger vehicles and cab-over-engine commercial vehicles.



Transverse section of barrel-type engine

The engine herewith illustrated has 12 cylinders of 3 1/16-in. bore by 3¾-in. stroke, making its displacement 330 cu. in. From the photograph of the cam plate it will be seen that the edge of the plate forms two complete sine waves, and one revolution of the engine shaft, therefore, corresponds to four strokes of each piston or to a complete cycle of the four-cycle engine.



Chief component parts: Cylinder block, cylinder head with exhaust manifold, main shaft with cam plate, valve cam and double piston

Barrel-Type Engine

The estimated output is 140-150 hp. at 1900 r.p.m.

From the photographs it will be seen that six cylinders are cast in one block and that two such blocks are flange-bolted together end to end. The cylinder bores are in the outer end of each block, while the inner ends form a chamber in which the cam plate revolves. Pistons are cast in pairs which are connected by a solid web on which are carried two rollers contacting with the cam plate. Oppositely located bores naturally are finished in one operation and, therefore, are in perfect alinement. Also, the pins for the rollers on the pistons are straddle-mounted, so the rollers are rigidly supported. Both the inlet and the exhaust valves are located in the cylinder heads and the combustion chambers are shaped to produce an anti-detonating effect.

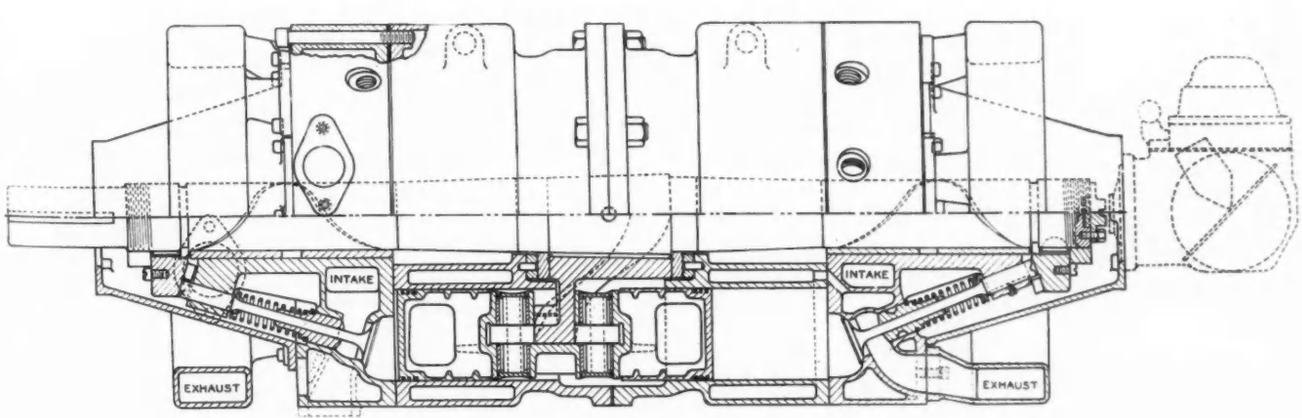
In the part-sectional view reproduced herewith, the arrangement of the inlet and exhaust valves is clearly shown, as at one end of the engine the section is through the center line of the inlet-valve and at the other end through the exhaust-valve. Both valves are inclined to the cylinder axes and to the axis of the main shaft of the engine the object being to bring the valve tips closer to the main shaft, as the valves are actuated from it through the intermediary of two cam plates, one at each end. These cam plates are provided with beveled cam faces perpendicular to the axes of the valve stems or nearly so, and each of the plates has two cam lobes, an inner one actuating all six exhaust valves of the block at that end and an outer one actuating all six inlet valves.

The inlet manifold consists of an annular chamber around the main bearing, and valve passages extend from this chamber radially outward to the six inlet-valve pockets. In an engine of this type the manifolding problem is entirely different from that in a conventional design, as the cylinders fire in direct sequence all around the block and there are no dead-end effects in the manifold to contend with.

Cooling water first enters the jacket on the cylinder heads and is discharged from a manifold in the vicinity of the exhaust passages, so effective cooling of the exhaust valves and their seats is provided for.

The experimental model of which photographs are reproduced herewith has the same cylinder dimensions as the Ford V-8 engine and is

(Turn to page 914, please)



Herrmann barrel-type engine, longitudinal, part-sectional view.

Just Among Ourselves

After Dissension Comes Peace

IF you have read Dr. Wolman's address which begins on page 898 of this issue you may not be inclined to think that the editor was full of the "peace-on-earth-good-will-to-men" spirit which is so definitely a part of the Christmas spirit. But it is true also that ignoring the "seeds of dissension" sifted from our native American air by Dr. Wolman, will never, never produce that reasonable amount of industrial peace which we all crave. Which brings us to the fact that we are printing Dr. Wolman's talk as being a real contribution to industrial peace; for it represents the findings of a reasonable man and reasonable men are rare.

His approach to the problem is essentially negative, but there are a lot of negatives to be got through on the labor question before something positive and equitable comes out of the present uncertainty.

The Wagner Act will be among us, and between us, for some time. It may be another year before amendments of any consequence are added unto it. Remembering this, doesn't the original Automobile Labor Board seem in the distance, like a beautiful dream of equity and propriety?

A Bad Start to a General Airing

LAST week in Washington a sub-committee of the House Committee on Interstate and Foreign Commerce held hearings on the Withrow resolution, which would give the Federal Trade Commission $50,000 to conduct an investigation of factory-dealer relations in the automobile industry. The preliminary hearings on the resolution didn't go too well from anyone's point of view except perhaps Mr. Withrow's and the committee's.

On top of that, the attorney-general's office seeks the impeachment of a Federal judge in Milwaukee, because, it is alleged, he was entirely too hasty in discarding some business concerning the relations between finance companies, automobile manufacturers and their dealers. Such a contretemps, occurring at this time, comes definitely under the head of a bad break, entirely disregarding the questions involved.

Unless some better breaks show up during the next few weeks, it is our feeling that the automobile industry is in for a Federal Trade Commission going over. The National Automobile Dealers Association has gone on record as seeking a quiet, scholarly private investigation. The industry has recorded its desire for a complete public airing of the facts. The N. A. D. A. knows, undoubtedly, that no investigation of the sort can be private and merely offered the point to discredit the idea that it was looking for a ring in which to hold a circus.

To Lobby or Not to Lobby

A YEAR or more ago, Arthur Krock, able *New York Times* representative in Washington, told a group of the industry's executives in Detroit that it was high time for automobile people to undertake an aggressive and definite information-spreading program in the Capital. Traditionally, the industry has refrained from a policy which might be called lobbying. Mr. Krock thought that some of it might be desirable. It looks as if he were right.

To All From All

IF you can forget for a moment these Jeremiads in earlier paragraphs you will be ready for the better wishes of the season. We (the editor and staff) of AUTOMOTIVE INDUSTRIES, send to 10,000 subscribers, 45,000 readers, and the small part of the industry not included in this group, our best wishes for a delightful Christmas and a stabilized New Year. Three thousand letters during the current year have told us that you wish us well. Three thousand and one thanks to all of you. Sincerely.—H. H.

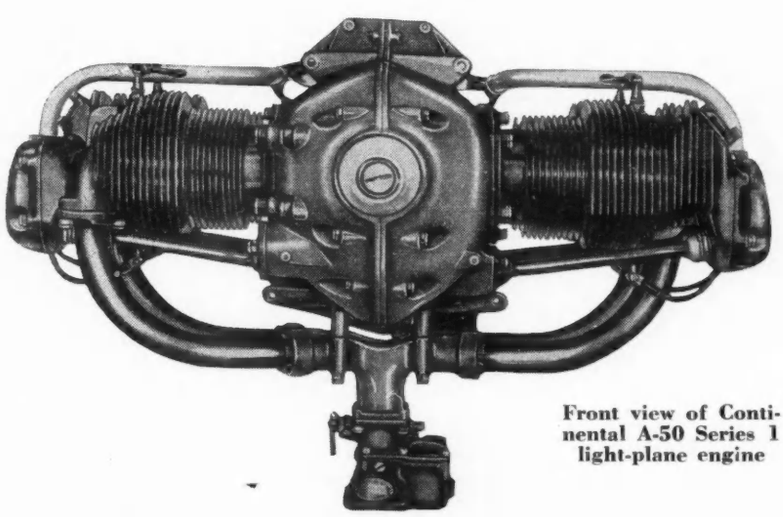
Continental Develops 50 hp. Engine for Small Planes

EARLY in January next deliveries will begin of a new Continental engine for light aircraft, the A-50, which will be supplied in three series differing with respect to items of equipment furnished with them. The A-50 is of the same general type as the Continental A-40, which now powers the Cub, Taylorcraft, Aeronca, and other low-priced planes. Series 1 carries a minimum of equipment, viz., a Scintilla magneto, a pressure oil pump, and a tachometer drive. It has dry-sump lubrication with gravity scavenging. Series 3 is identical with Series 1 except that it carries two Scintilla magnetos, in conformity with export requirements, while the equipment of Series 2 is quite extensive, including dual battery ignition (Auto-Lite or Scintilla), drives for an Eclipse starter and an Eclipse or Auto-Lite generator, both scavenge and oil-pressure pumps, an A.C. automotive fuel pump, radio shielding, and a tachometer drive.

General specifications of the engine are given in accompanying table, and a photograph showing a front view of the Series 1 is reproduced herewith. The new engine develops 50 hp., or 25 per cent more than the A-40, and therefore should give much better performance when installed in planes which heretofore have carried the latter engine, as there is little difference between the weights of the two. The fuel consumption is given as 4½ gals. per hour for an output of 50 hp., which is reduced to 11 quarts per hour for cruising at 85 per cent the r.p.m. of level flight under full throttle. The oil consumption is said to be less than one pint per hour. Changes in output and specifie fuel consumption with engine speed are shown in the accompanying graph.

General Specifications

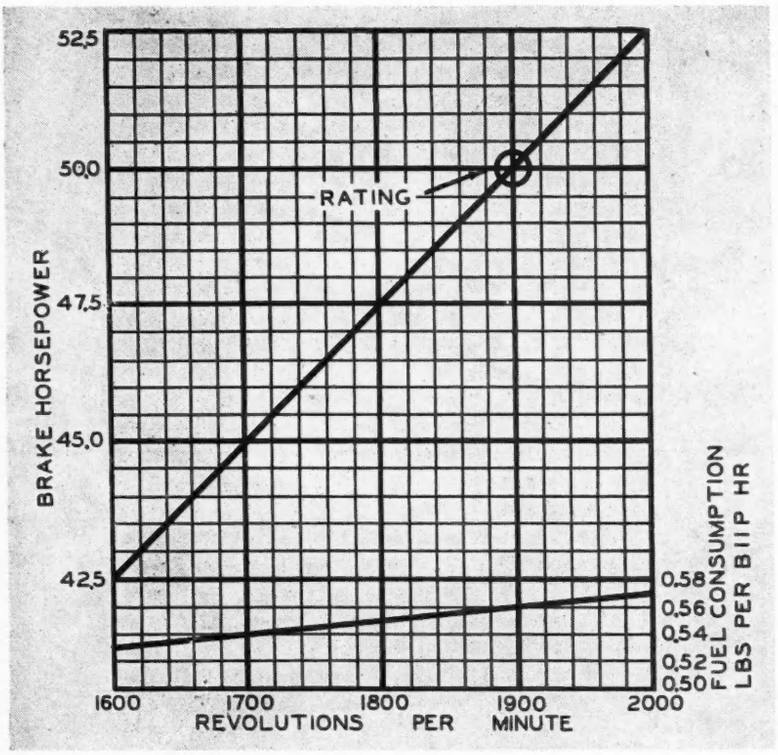
Continental A-50—Direct drive.
Type: Aircooled, two-bank, horizontally opposed.
Number of Cylinders: 4.
Bore: 3⅞ in.
Stroke: 3⅝ in.
Displacement: 171 cu. in.
Compression Ratio: 5.4 to 1.
Fuel: Gasoline 65 octane minimum, 70 octane or better recommended.
Power Rating: 50 hp. at 1900 r.p.m.
Weight: 150 lb. (Series 1).
Length Overall: 30-13/32 in. (Series 1).
Width: 31-11/16 in. (All series).
Height: 23 in. (All series).
Mount Bolt Centers: 7 in. width upper, 10½ in. width lower, 11-9/16 height.



Front view of Continental A-50 Series 1 light-plane engine

A feature of the new engine is the use of the Wilcox-Rich hydraulic tappets, of which this is the first application to aircraft engines. With these tappets the valve timing is not affected by temperature changes, and this feature, combined with automatic lubrication of the valve mechanism is expected to minimize maintenance and repair requirements. The engine is completely sealed against oil leakage and the escape of fumes. At present the new model is undergoing factory dynamometer tests with test clubs, as well as flight tests, and we understand that application has been made to the Department of Commerce for an approved type certificate.

Each cylinder has a single rocker box enclosing the two overhead Jadson valves, whose axes are located



Variation of output and specific fuel consumption with speed. Aviation gasoline of 65 octane and wide-open throttle was used

in the longitudinal plane of the engine. The rocker-box cover is a light die casting which is fastened to the cylinder head with six studs and nuts. There are large cooling fins on the exhaust port, combustion chamber, and spark-plug bosses, but air jackets, baffles or cowls are required to ensure cross flow of air over the cylinder head between valve ports. Cooling tests indicate that with 75 deg. cooling air the maximum head temperature can be kept below 400 deg. Fahr. and the cylinder-base temperature below 200 deg. Fahr. without difficulty.

Cylinder constructional features are conventional. The finned, forged steel barrel is screwed and shrunk into the cylinder head of Alcoa heat-treated aluminum alloy. Valve-seat inserts and spark-plug bushings are of aluminum bronze, while the valve guides are of a special bronze that is said to assure long life for this part. The two Jadson valves are located in the flattened, narrowed crown of the dome. Spark plugs are located between the valves in pents extending into the combustion chamber, to avoid possible oil fouling from the piston. Each valve is operated by a rocker arm, a push rod, and a Wilcox-Rich hydraulic tappet—all enclosed and sealed against oil leakage. Engine oil is forced into the tappet through the push rod and rocker arm, to the rocker arm bushing, and to the valve tip. Splash wets the valve stem and guide. Oil returns to the crankcase by way of the push-rod housings. The cylindrical steel tappet has a flat-faced, hardened end that bears directly on the cam.

The camshaft is cast of Proferall by Campbell-Wyant & Cannon, and has hardened cams and journals. There are six cams, three journals, and an overhung eccentric at the propeller end to operate the fuel pump. The exhaust cams are adjacent to the journals. Intake valves of opposing cylinders are actuated by a single cam. At the rear end is a flange to which a gear is attached by capscrews.

The one-piece, forged-alloy-steel, four-throw crankshaft is supported by steel-backed, cadmium main bearings at the center and both ends. The crankshaft is drilled for lightness and for pressure lubrication of the crankpins. Plain thrust faces are formed on the propeller-end throw and on a shoulder near the propeller, so that these engines can be used for either tractor or pusher installations. The propeller end has an S.A.E. No. "0" taper. At the opposite end the crankshaft has a flange to which is fastened, by capscrews, a spur gear to drive the camshaft and accessories.

The crankcase is a two-piece, heat-treated casting of Alcoa aluminum alloy, bolted together in the vertical lengthwise plane through the crankshaft and camshaft. Rigid transverse webs support the three main and three camshaft bearings. A Chicago Rawhide seal prevents oil leakage at the propeller. The large tappet guides are formed in the crankcase in a plane below and parallel to the cylinders. Cast-in lengthwise tubes lead oil under pressure to the tappet guides, the camshaft, and the main bearings. Four engine mounting bosses for ⅜ in. bolts are provided at the rear of the crankcase, as in radial engines. According to the Lord Mfg. Co., Erie, Pa., the engine torque can be taken by rubber bushings in shear without difficulty. This type of rubber mounting minimizes engine excitation of airplane vibrations.

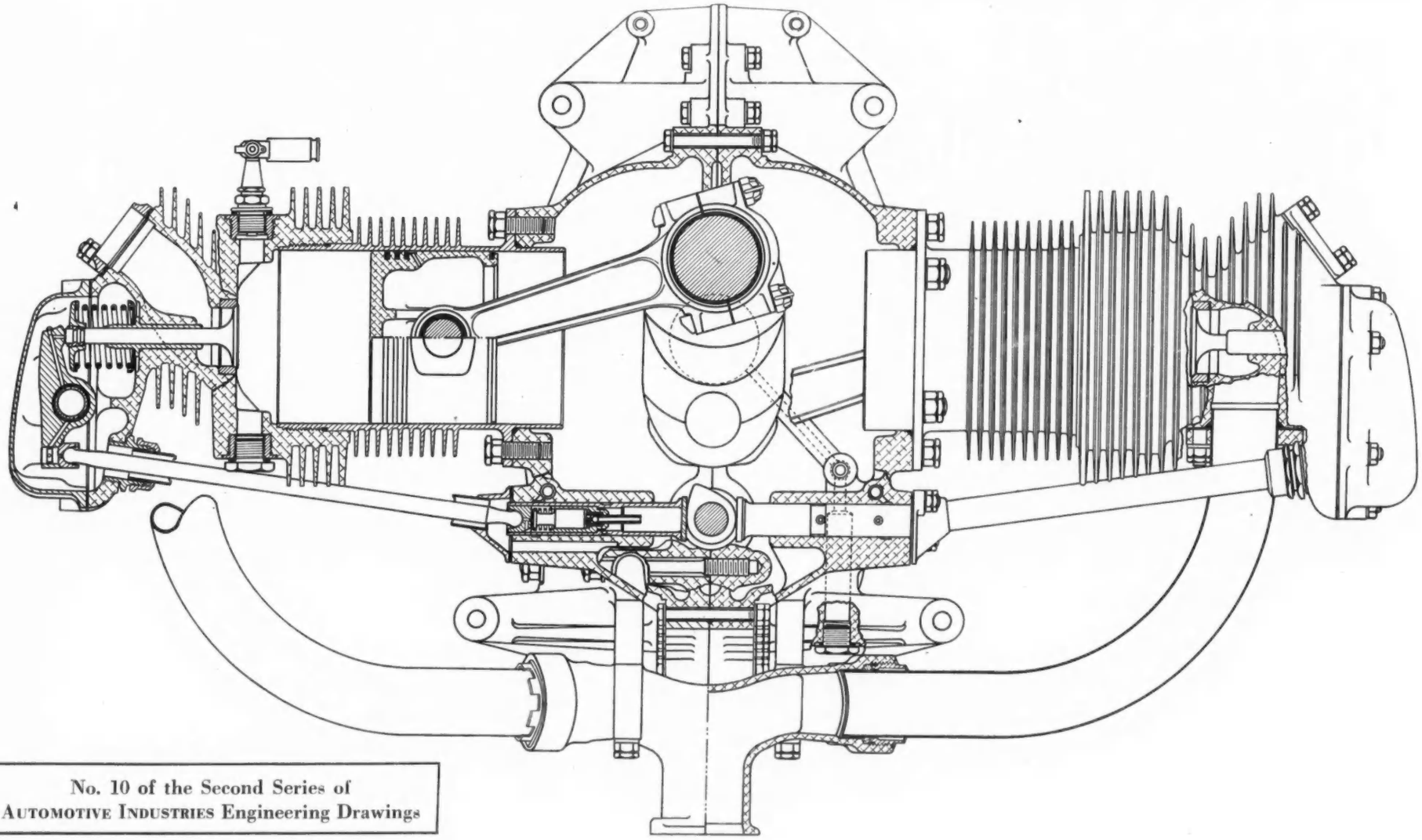
The alloy-steel connecting rods are of conventional design. The split big-end bearing is of the replaceable thin-steel-shell type, with a cadmium bearing lining. A bronze bushing is pressed in the piston-pin end.

The pistons are cast in permanent molds of Alcoa "Lo-Ex" alloy. Piston pins are full-floating and are restrained by a button at each end. Pistons carry two compression rings and two oil rings—one above and one below the piston pin—all American Hammered.

The gearcase casting at the anti-propeller end provides supports for ignition units, oil pumps, tachometer drive, starter and generator (Series 2). The gearcase has two crankcase vents, one to be connected to the oil tank, the other to the carburetor entrance. Lubrication system features include an oil drain at the bottom, a pressure-oil-line screen, an oil-pressure relief valve, and drilled oil lines to connect with the crankcase oil-feed lines. The gearcase with accessories is removable, as a unit. Gearcases of the various series are different.

Carburetion is by a Stromberg NA-S3 updraft carburetor, connected to a cast-aluminum "X" manifold jacketed for exhaust-hot spotting. This manifold is secured by four studs to the under side of the crankcase, midway between the cylinders. Steel intake pipes connect this manifold to all four intake ports. Tests show that an air-intake scoop with "egg-crate" type straightener vanes at the carburetor entrance is required for uniform fuel distribution to the four cylinders.

(Turn to page 914, please)

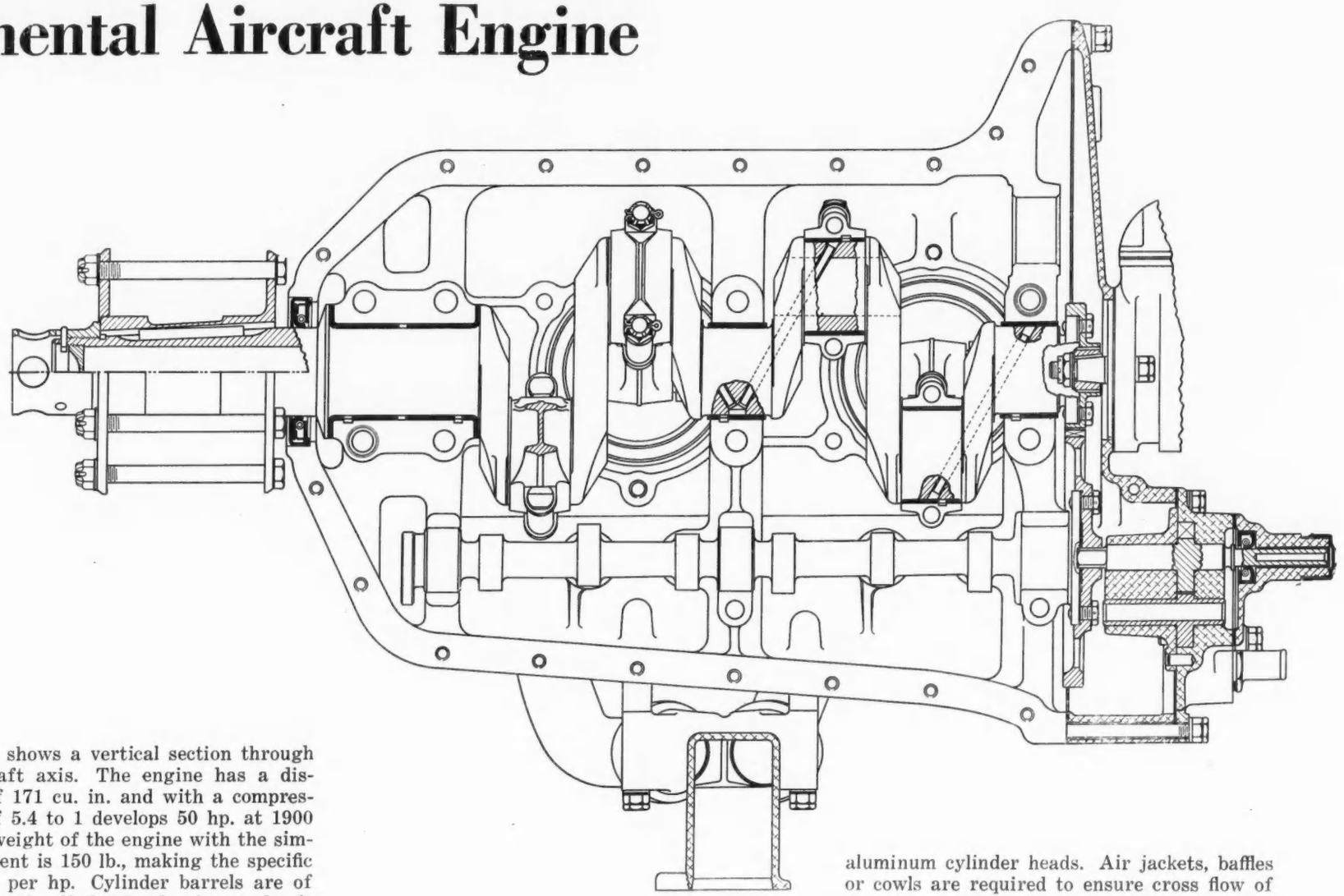


No. 10 of the Second Series of
AUTOMOTIVE INDUSTRIES Engineering Drawings

Continental Aircraft Engine

Four-Cylinder Horizontal Opposed, 3 7/8-in. Bore by 3 5/8-in. Stroke.

Continental Aircraft Engine



This view shows a vertical section through the crankshaft axis. The engine has a displacement of 171 cu. in. and with a compression ratio of 5.4 to 1 develops 50 hp. at 1900 r.p.m. The weight of the engine with the simplest equipment is 150 lb., making the specific weight 3 lb. per hp. Cylinder barrels are of forged steel and cylinder heads of cast aluminum, the barrels being screwed and shrunk into the heads. The crankshaft is supported in three main bearings. A feature of the engine is the use of Wilcox-Rich hydraulic tappets in the valve gear. The camshaft is located centrally below the crankshaft. It is cast of Proferall and has hardened cams and journals. An overhung eccentric at the propeller end of the camshaft operates the fuel pump. Intake valves of opposite cylinders are actuated by the same cam, but there is a separate cam for each exhaust valve. Aluminum bronze is used for the valve-seat inserts in the cast aluminum cylinder heads. Air jackets, baffles or cowls are required to ensure cross flow of the air over the cylinder head between valve ports. The gearcase casting at the rear end provides supports for the ignition units, oil pumps, tachometer drive, starter and generator. Carburetion is by a Stromberg updraft carburetor connected to a cast-aluminum manifold which is secured by four studs to the under side of the crankcase.

An Analysis of 86 Stock Transmissions

In this discussion of trends data have been taken from the specification tables presented on the two following pages.

IN the accompanying table of specifications are listed the products of eight manufacturers of stock transmissions. Only one of these manufacturers lists transmissions for passenger cars, those of all other manufacturers being intended for trucks and buses, and in some instances for tractors, which, however, refers, in most cases at least, to highway tractors and not to farm tractors. In addition to specifications of conventional transmissions, the table also contains specifications of a number of reversing gears and overdrives, and in the following analysis of transmission-gear practice as represented by the products of specialists, these units have been neglected.

Of the 86 transmissions with three or more forward speeds, 20 have three forward speeds, 29 four speeds, and 36 have five speeds, while there is one transmission with as many as eight forward speeds. Naturally, the range of gear ratios obtainable varies with the number of forward speeds, and the different ratios in general are very close to a geometrical progression, though in the multi-speed transmissions there is a tendency to place the gear ratios at the low-speed end somewhat farther apart, and those at the high-speed end closer together. Of course, the high-speed ratios are used by far the greater part of the time, and the object in placing them closer together, no doubt, is to make it possible for the driver to use his engine to best advantage the greater part of the time. Spacing the lower gear ratios farther apart, of course, gives a lower emergency ratio, and therefore greater ability to meet extreme conditions.

In the transmission with three forward speeds, the average low-gear ratio is 3.07 and the average intermediate ratio is 1.79. These values together with the direct-drive ratio of 1 form nearly a geometrical progression, because the square root of 3.07 is 1.75. In the transmissions with four forward speeds the average ratios of the different speeds are as follows: Low, 5.62; second, 3.37; third, 1.76. In this case the ratio of the low to the second is 1.67; in other words, the two lowest ratios are more closely spaced than the two highest. On the other hand, the ratio of the second to the third is 1.915, and these two speeds are, therefore, spaced most widely. A geometrical progression giving the same low-gear ratio would give a second-speed ratio of 3.17 and a third-speed ratio of 1.78.

In the five-speed transmissions the average ratios of the various gears are as follows: Low gear, 7.12; second, 4.04; third, 2.34, and fourth, 1.535. This makes the ratios between successive gears as follows: Ratio of low to second, 1.765; second to third, 1.73; third to fourth, 1.525, and fourth to fifth, 1.535. Here, as in the preceding type, the ratios at the high-speed end are closer together, while those at the low-speed end are farther apart. In addition to the advantage already mentioned, more closely spaced ratios at the high-speed end facilitate shifting, and there is, of course, much more shifting between fourth and fifth than between first and second.

Thirty of the 86 transmissions covered by this survey are provided with overdrives, and the average overdrive ratio is 0.76.

Bearing equipment in these stock transmissions seems to be pretty evenly divided between the ball and roller types. On main shafts ball bearings predominate, 66 transmissions having ball bearings only on this shaft; four, roller bearings only; and the remaining 16, both ball and roller bearings. Most of the pilot bearings in the transmission (77 out of 86) are of the roller type, which is explained by the fact that the bearing in this location must be of rather small outside diameter. All of the remaining nine transmissions have ball pilot bearings, and the pilot bushing, which at one time was a source of much trouble because of the difficulty of lubricating it properly, has disappeared entirely (in stock transmissions, at least). On the countershaft, 19 of the transmissions have roller bearings only, 20 ball bearings only, 41 have both ball and roller bearings, and three have bronze bushings.

An interesting study is that of the gear pitches in use. It will be noticed that most of the gears for low-forward and reverse speeds have compound pitch numbers, which means that these gears are of the stub-tooth type. The stub tooth has the advantage of greater resistance to bending stresses, and its use is, therefore, indicated for low-speed

(Text continues on page 912)
(Specification tables on next 2 pages)

AMERICAN STOCK

MAKE AND MODEL		Designed for	No. of Forward Speeds	Direct Drive On	GEAR RATIOS (to-1) Low	Second	Third	Fourth	Fifth	Reverse	Overdrive	BEARINGS Type	Main Shaft	Pilot	Countershaft	Inside distance between bearings on Main Shaft (Ins.)	Distance between center lines of Main & Countershafts (Ins.)	Type of Direct Drive Clutch	TYPE OF GEAR TEETH Low	Second	Third	Fourth	Fifth
Brown-Lipe	221	T, Tr	2	1	1.00						.75	Con	Ball	Rol	Rol		4.00	G-T	Dir	Sp			
Brown-Lipe	222	T, Tr	2	2	1.52	1.00						Con	Ball	Rol	Rol		4.00	G-T	Sp	Dir			
Brown-Lipe	231	T, Tr	2	1							.75	Con	Ball	Rol	Rol		4.00	G-T	Dir	Sp			
Brown-Lipe	232	T, Tr	2	2	1.52°							Con	Ball	Rol	Rol		4.00	G-T	Sp	Dir			
Brown-Lipe	1431	Buses	3	3	2.78	1.86	1.00			3.37		Con	Ball	Rol	Rol		4.09	G-T	Sp	Hl	Dir		
Brown-Lipe	2252	Trucks	5	5	7.32	4.25	2.75	1.40	1.00	7.32		Con	Ball	Rol	B&R		4.42	G-T	Sp	Sp	Hl	Hl	Hl
Brown-Lipe	2253	Trucks	5	4	6.15	3.58	1.86	1.00	.77	6.15	.77	C&C	Ball	Rol	Ball		4.42	G-T	Sp	Sp	Hl	Hl	Hl
Brown-Lipe	2341	T, B, Tr	4	4	6.27	3.04	1.65	1.00		7.53		C&C	Ball	Rol	B&R		4.21	G-T	Sp	Sp	Hl	Dir	
Brown-Lipe	2352	Trucks	5	5	7.70	4.55	2.35	1.45	1.00	7.70°		Con	Ball	Rol	B&R		4.75	G-T	Sp	Sp	Hl	Hl	Dir
Brown-Lipe	2353	Trucks	5	4	6.12	3.62	1.87	1.00	.79	6.12°	.79	Con	Ball	Rol	B&R		4.75	G-T	Sp	Sp	Hl	Hl	Hl
Brown-Lipe	3221	T, Tr	2	1	1.00						.79	Con	Ball	Ball	Ball		4.75	G-T	Dir	Sp			
Brown-Lipe	3222	T, Tr	2	2	2.15	1.00						Con	Ball	Ball	Ball		4.75	G-T	Hl	Dir			
Brown-Lipe	3241	Trucks	4	4	7.00	3.90	1.86	1.00		8.10		C&C	B&R	Rol	Ball		4.75	G-T	Sp	Sp	Hl	Hl	
Brown-Lipe	3341	T, B	4	4	6.30	3.51	1.68	1.00		7.29		C&C	B&R	Rol	Ball		4.75	G-T	Sp	Sp	Hl	Hl	
Brown-Lipe	3352	Trucks	5	5	7.93	4.58	2.47	1.46	1.00	7.93°		C&C	Ball	Rol	B&R		5.50	G-T	Sp	Sp	Hl	Hl	Hl
Brown-Lipe	3353	Trucks	5	4	6.54	3.77	1.92	1.00	.77	6.54	.77	C&C	Ball	Rol	B&R		5.50	G-T	Sp	Sp	Hl	Hl	Hl
Brown-Lipe	3440	Trucks	4	3	3.87	1.86	1.00	.73		4.48	.73	C&C	B&R	Rol	B&R		4.75	G-T	Sp	Sp	Dir	Hl	
Brown-Lipe	3481	Trucks	8	7	8.31	4.00	3.87	2.15	1.86*	9.62°	.73	C&C	B&R	Rol	Ball		4.75	G-T	Sp	Sp	Hl	Hl	Hl
Brown-Lipe	5031	Buses	3	3	4.03	1.98				4.96		C&C	B&R	Rol	Rol		4.25	Sp	Hl				
Brown-Lipe	5221	T, Tr	2	1	1.00	2.34						Con	Ball	Ball	Ball		5.50	Dir	Hl				
Brown-Lipe	5222	T, Tr	2	2	2.34	1.00						Con	Ball	Ball	Ball		5.50	Hl	Dir				
Brown-Lipe	5241	Trucks	4	4	7.15	3.45	1.83	1.00		8.13		C&C	B&R	Rol	Ball		5.50	G-T	Sp	Sp	Hl	Hl	
Brown-Lipe	5251	Trucks	5	4	7.15	3.45	1.83	1.00	.80	8.13	.80	C&C	B&R	Rol	Ball		5.50	G-T	Sp	Sp	Sp	Hl	Hl
Brown-Lipe	5331	Buses	3	3	3.72	1.88	1.00			4.21		C&C	Ball	Rol	Ball		4.75	G-T	Hl	Hl	Dir		
Brown-Lipe	5341	T, B	4	4	6.63	3.20	1.70	1.00		7.53		C&C	B&R	Rol	Ball		5.50	G-T	Sp	Sp	Hl	Hl	
Brown-Lipe	5351	Trucks	5	4	6.63	3.20	1.70	1.00	.74	7.53	.74	C&C	B&R	Rol	Ball		5.50	G-T	Sp	Sp	Hl	Hl	Hl
Brown-Lipe	5352	Trucks	5	5	7.70	4.85	2.56	1.43	1.00	7.80		C&C	B&R	Rol	Ball		5.50	G-T	Sp	Sp	Sp	Hl	Dir
Brown-Lipe	5440	T, Tr	4	3	3.90	1.88	1.00	.75		4.43	.75	C&C	B&R	Rol	B&R		5.50	G-T	Sp	Sp	Dir	Hl	
Brown-Lipe	6031	Trucks	3	2	2.22	1.00	.69				.69	Con	Rol	Rol	Rol		5.10	G-T	Hl	Hl			
Brown-Lipe	7131	Buses	3	3	3.80	1.74	1.00			3.41		C&C	Ball	Ball	Rol		6.50	G-T	Hl	Hl	Hl		
Brown-Lipe	7241	T, B, Tr	4	4	7.10	3.89	1.96	1.00		9.24		C&C	B&R	Ball	B&R		6.50	G-T	Sp	Sp	Hl	Dir	
Brown-Lipe	7341	T, B, Tr	4	4	6.27	3.43	1.73	1.00		8.15		C&C	B&R	Ball	B&R		6.50	G-T	Sp	Sp	Hl	Dir	
Brown-Lipe	7351	T, Tr	5	4	6.27	3.43	1.73	1.00	.67	8.15	.67	Con	B&R	Rol	B&R		6.50	G-T	Sp	Sp	Hl	Dir	Hl
Brown-Lipe	7440	T, Tr	4	3	3.72	2.04	1.00	.77		4.84	.77	C&C	B&R	Ball	B&R		6.50	G-T	Sp	Sp	Dir	Hl	
Brown-Lipe	2321	Trucks	2	1	1.00						.75	Con	B&R	Rol	Rol	5 7/8	4.00	G-T	Hl				
Brown-Lipe	2323	Trucks	2	2	1.58	1.00						Con	B&R	Rol	Rol	5 7/8	4.00	G-T	Hl				
Brown-Lipe	2441	Trucks	4	4	6.12	3.10	1.70	1.00		7.27		Con	Ball	Rol	B&R	9 1/4	4.75	G-T	Hl	Hl	Hl	Dir	
Brown-Lipe	2452	Trucks	5	5	7.12	4.20	2.33	1.66	1.00	7.45		C&C	Ball	Rol	B&R	11 9/16	4.75	G-T	Hl	Hl	Hl	Hl	Dir
Brown-Lipe	2453	Trucks	5	4	6.12	3.62	2.00	1.00		6.40	.80	C&C	Ball	Rol	B&R	11 9/16	4.75	G-T	Hl	Hl			Hl
Clark	170FS	Trucks	4	4	6.57	3.53	1.74	1.00		7.88		Cl	Ball	Rol	Rol	8 5/16	4.07	G-T	Sp	Sp	Sp	Dir	
Clark	B-300	Trucks	4	4	6.57	3.58	1.73	1.00		7.88		Cl	Ball	Rol	Rol	8 5/16	4.07	G-T	Sp	Sp	Sp	Dir	
Clark	301	Tr, B	4	4	3.70	2.54	1.92	1.00		4.44		Cl	Ball	Rol	Rol	8 5/8	4.07	G-T	Sp	Sp	Sp	Dir	
Clark	185-F	Trucks	4	4	6.35	3.31	1.73	1.00		7.54		C&C	Ball	Rol	B&R	8 1/2	4.33	G-T	Sp	Sp	Hl	Dir	
Clark	200-V	T, B	5	5	7.58	4.38	2.41	1.48	1.00	6.10	Op	C&C	Ball	Rol	B&R°	11 1/32	4.75	G-T	Sp	Sp	Hl	Hl	Dir
Clark	200-VO	T, B	5	4	6.06	3.50	1.91	1.00		4.87	.799	C&C	Ball	Rol	B&R	11 1/32	4.75	G-T	Sp	Sp	Hl	Dir	Hl
Clark	202-V	T, B	5	5	7.58	4.38	3.05	1.72	1.00	6.11		C&C	Ball	Rol	B&R	11 1/32	4.75	G-T	Sp	Sp	Hl	Hl	Dir
Clark	202-VO	T, B	5	4	5.25	3.15	1.80	1.00	.799	3.88	.799	C&C	Ball	Rol	B&R	11 1/32	4.75	G-T	Sp	Sp	Hl	Dir	Hl
Clark	230-F	Buses	4	4	5.00	3.07	1.71	1.00		5.83		C&C	Ball	Rol	B&R	10 1/16	4.33	G-T	Sp	Hl	Hl	Dir	
Clark	231-F	Trucks	4	4	6.35	3.37	1.72	1.00		7.40		C&C	Ball	Rol	B&R	10 1/2	4.33	G-T	Sp	Hl	Hl	Dir	
Clark	270-V	T, B	5	5	7.88	4.46	2.63	1.48	1.00	7.88	Op	C&C	Ball	Rol	B&R°	13 3/8	5.50	G-T	Sp	Sp	Hl	Hl	Dir
Clark	270-VO	T, B	5	4	7.00	3.97	1.90	1.00		7.00	.788	C&C	Ball	Rol	B&R	13 3/8	5.50	G-T	Sp	Sp	Hl	Dir	Hl
Clark	325-VO	T, B	5	4	7.08	4.12	1.90	1.00		8.05	.768	C&C	Ball	Rol	B&R	15 3/4	5.90	G-T	Sp	Sp	Hl	Dir	Hl
Clark	140-T	Trucks	3	3	3.46	1.71	1.00			4.25		C&C	Ball	Rol	Rol	7 1/8	3.357	G-T	Sp	Hl	Dir		
Clark	187-F	Tr	4	4	5.00	2.61	1.89	1.00		5.94		C&C	Ball	Rol	B&R	9 1/2	4.333	G-T	Sp	Sp	Hl	Dir	
Clark	204-V	T, B	5	5	7.58	4.38	3.05	1.72	Dir	7.51		C&C	Ball	Rol	B&R	12 5/8	4.75	G-T	Sp	Sp	Hl	Hl	Dir
Clark	204-VO	T, B	5	4	6.06	3.50	1.80	1.00		6.00	.799	C&C	Ball	Rol	B&R	12 5/8	4.75	G-T	Sp	Sp	Hl	Hl	Dir
Clark	272-V	T, B	5	5	7.88	4.46	3.09	1.74	Dir	(a)		C&C	Ball	Rol	B&R	13 3/8	5.50	G-T	Sp	Sp	Hl	Hl	Dir
Clark	272-VO	T, B	5	4	7.00	3.97	1.81	1.00		(b)	.788	C&C	Ball	Rol	B&R	13 3/8	5.50	G-T	Sp	Sp	Hl	Dir	
Clark	326-V	T, B	5	5	8.05	4.34	2.71	1.67	Dir	(c)		C&C	Ball	Rol	B&R	15 3/4	5.90	G-T	Sp	Sp	Hl	Hl	Dir
Clark	326-VO	T, B	5	4	6.51	3.51	1.75	1.00		(d)	.773	C&C	Ball	Rol	B&R	15 3/4	5.90	G-T	Sp	Sp	Hl	Dir	
Cotta	A	T, B, Tr	4	4	5.20	3.68	1.85	1.00		4.66		Con	Ball	Rol	B&G	12 1/2	4.50	Jaw	Sp	Sp	Sp	Sp	
Cotta	FA	T, Tr	3	3	4.00	2.00	1.00			4.12		Con	Ball	Rol	B&G	16 1/2	6.75	Jaw	Sp	Sp			
Cotta	FAA	T, Tr	1–2	2	4.75	1.00				4.12		Con	Ball	Rol	B&G	8 1/2	6.75	Jaw	Sp	Sp			
Cotta	JR		1	1						1.00		Con	Ball	Rol	Rol	5 3/8	4.50	Jaw	Sp				
Cotta	RAU	T, Tr, B	3	3	3.68	1.85	1.00			4.66		Con	Ball	Rol	Ball	11 1/2	4.90	Jaw	Sp	Sp	Sp		
Cotta	SAU	T, Tr, B	3	3	3.68	1.85	1.00			4.66		Con	Ball	Rol	Ball	13	5.40	Jaw	Sp	Sp	Sp		
Cotta	TAU	T, Tr, B	3	3	5.20	2.50	1.00			4.66		Con	Ball	Rol	Ball	14 1/4	6.00	Jaw	Sp	Sp	Sp		
Cotta	T	T, Tr, B	4	4	5.20	3.68	1.85	1.00		4.66		Con	Ball	Rol	Ball	18 1/2	6.00	Jaw	Sp	Sp	Sp	Sp	
Cotta	TS	T, Tr	1–2	1	5.20	1.00				4.66		Con	Ball	Rol	Ball	7 1/4	6.00	Jaw	Sp	Sp			
Cotta	ZA	Buses	3	3	2.88	1.56	1.00			4.66		C&C	Ball	Rol	Ball	14	5.50	G-T	Sp	Sp	Sp		
Cotta Gear	55	T, B	5	5	8.31	4.75	2.80	1.60	1.00	5.30		Con	Ball	Ball	Ball	11 3/8	5.00	Jaw	Sp	Sp	Sp	Sp	Sp
Cotta Gear	45-U	Trucks	5	5	8.50	4.68	2.92	1.59	1.00	5.95		Con	Ball	Ball	Ball	10 3/4	4.50	Jaw	Sp	Sp	Sp	Sp	Sp
Cotta Gear	65	T, B	5	5	8.31	4.75	2.80	1.60	1.00	6.33		Con	Ball	Ball	Ball	12 1/2	5.40	Jaw	Sp	Sp	Sp	Sp	Sp
Fuller	3-A-86	Trucks	3	2	1.99	1.00				No	.77	Con	Ball	Ball	Ball	15.47	6.10	G-T	He	Dir	He		
Fuller	2-A-53	Trucks	2	2	2.08	1.00				No		Con	Ball	Rol	Ball	5.09	5.83	G-T	He	Dir			
Fuller	2-A-53	Trucks	2	2	1.58	1.00				No		Con	Ball	Rol	Ball	5.09	5.83	G-T	He	Dir			
Fuller	AR-1.63	Trucks	2	2	1.63	1.00				No		C&C	Ball	Rol	Ball	5.52	4.90	G-T	Sp	Dir			
Fuller	AR	Trucks	1	1	1.00					1.00		C&C	Ball	Rol	Ball	5.52	4.90	G-T	Dir				
Fuller	UR-1.63	Trucks	2	2	1.63	1.00				No		C&C	Ball	Rol	Ball	5.52	4.90	G-T	Sp	Dir			
Fuller	UR	Trucks	1	1	1.00					1.00		C&C	Ball	Rol	Ball	5.52	4.90	G-T	Dir				
Fuller	MHU	T, B	4	4	6.27	3.17	1.74	1.00		7.94		C&C	Ball	Ball	Ball	12.25	5.25	G-T	Sp	Sp	Sp	Sp	
Fuller	2SC-2.75	T, B	2	2	2.75	1.00				No		C&C	Ball	Ball	Ball	4.66	3.84	G-T	Sp	Dir			
Fuller	5-A-33 & 5-B-33	T, B, Tr	5	5	7.53	4.30	2.52	1.42	1.00	7.37		C&C	Ball	Rol	B&R	12.02	4.50	G-T	Sp	Sp	Hl	Hl	Dir
Fuller	5-A-330 & 5-B-330	T, B, Tr	5	4	6.10	3.48	2.04	1.00		5.96	.768	C&C	Ball	Rol	B&R	12.02	4.50	G-T	Sp	Sp	Hl	Dir	Hl
Fuller	5-F-33 & 5-G-33	T, B, Tr	5	5	7.53	4.30	2.52	1.42	1.00	7.37		C&C	Ball	Rol	B&R	12.02	4.50	G-T	Sp	Sp	Hl	Hl	Dir
Fuller	5-F-330 & 5-G-330	T, B, Tr	5	4	6.10	3.48	2.04	1.00		5.96	.768	C&C	Ball	Rol	B&R	12.02	4.50	G-T	Sp	Sp	Hl	Dir	Hl
Fuller	5-A-43	T, B, Tr	5	5	8.03	4.61	2.46	1.41	1.00	(p)		C&C	Ball	Rol	B&R	13.77	5.41	G-T	Sp	Sp	Hl	Hl	Dir
Fuller	5-A-430	T, B	5	4	6.52	3.33	1.77	1.00		(r)	.771	C&C	Ball	Rol	B&R	13.77	5.41	G-T	Sp	Sp	Hl	Dir	Hl
Fuller	5-A-62	T, B	5	5	8.08	4.67	2.62	1.38	1.00	(s)		C&C	Ball	Rol	B&R	15.31	5.83	G-T	Sp	Sp	Hl	Hl	Dir
Fuller	5-A-820	T, B	5	4	7.07	3.50	1.72	1.00		(t)	.776	C&C	Ball	Rol	B&R	15.31	5.833	G-T	Sp	Sp	Hl	Dir	Hl
Mann	B	Trucks	3	2	1.56	1.00				No	.72	Con	Ball	Rol	Ball	7 1/16	4.50	G-T	Cs	Cs			
Mann	200	Buses	4	4	5.00	2.85	1.70	1.00		4.36		Con	B&R	Rol	B&R	9 1/2	4.50	G-T	Ch	Ch	Ch	Ch	
Mann	U-300	T, B	4	4	5.06	2.80	1.64	1.00		4.66		Con	Rol	Rol	Rol	12 1/2	6.00	G-T	Cs	Cs	Cs	Cs	
Mann	M-300	T, B	4	4	5.06	2.80	1.64	1.00		4.66		Con	Rol	Rol	Rol	12 1/2	6.00	G-T	Cs	Cs	Cs	Cs	
Mann	600	Buses	4	4	5.22	2.78	1.67	1.00		4.06		Con	Rol	Rol	Rol	12 1/2	6.00	G-T	Ch	Ch	Ch	Ch	
Mann	600 Ov.	Buses	4	3	3.49	1.85	1.00			3.22	.75	Cl	Ball	Rol	Rol	12 1/2	6.00	G-T	Ch	Ch	Ch	Ch	
New Process	36280	Trucks	3	3	3.30	1.78	1.00			4.30		C&C	Ball	Rol	Rol	7 7/16	3.14	G-T	Sp	Hl	Hl		
New Process	36300	T, B	4	4	6.40	3.09	1.69	1.00		7.82		Cl	Ball	Rol	Rol	7 7/16	4.28	G-T	Sp	Sp	Sp	Sp	
Warner Gear	T85&T85A	Cars	3	3	2.52	1.51	1.00			3.15	.705	Csy	Ball	Rol	Rol	8.50	3.25	G-T	Hl	Hl	Hl		
Warner Gear	T-84D	Cars	3	3	2.66	1.56	1.00			3.55		Csy	Ball	Rol	BB	5.75	2.50	G-T	Hl	Hl	Sp		
Warner Gear	T-83	C, T	3	3	2.81	1.60	1.00			3.38		Csy	Ball	Rol	BB	7.06	2.93	G-T	Hl	Hl	Sp		
Warner Gear	T-82A	Cars	3	3	2.69	1.56	1.00			3.23	.705	Con	Ball	Rol	BB	9.68	3.50	G-T	Hl	Hl	Sp		
Warner Gear	T-9A	Trucks	4	4	5.90	3.09	1.69	1.00		7.21		Cl	Ball	Rol	Rol	7.31	4.28	G-T	Sp	Sp	Sp	Sp	
Warner Gear	T-9	Trucks	4	4	6.40	3.09	1.69	1.00		7.82		Cl	Ball	Rol	Rol	7.31	4.28	G-T	Sp	Sp	Sp	Sp	
Warner Gear	T-86A	Cars	3	3	2.57	1.55	1.00			3.48	.722	Csy	Ball	Rol	Rol	6.75	3.00	G-T	Hl	Hl	Hl		
Warner Gear	T-88	Cars	3	3	2.57	1.55	1.00			3.48	.722	Csy	Ball	Rol	Rol	6.75	3.00	G-T	Hl	Hl	Hl		

TRANSMISSIONS

USED FOR		GEAR TOOTH PITCH							MATERIALS					BRAKE					MAKE AND MODEL
Reverse	Countershaft Drive	Low	Second	Third	Fourth	Fifth	Reverse	Countershaft Drive	Housing	Shaft—S.A.E. No.	Gear—S.A.E. No.	Control Location	Sold with Clutch	Diameter (Ins.)	Width (Ins.)	Weight (Lbs.)	Recommended Type of Lubrication		
	Sp	.....	6	.....	.....	.....	.....	6	Cl	3115	4620	Si	.....	.....	.....	95	Oil	Brown-Lipe	221
	Sp	6	6	.....	.....	.....	.....	6	Cl	3115	4620	Si	.....	.....	.....	95	Oil	Brown-Lipe	222
		6	6	.....	.....	.....	.....	6	Cl	3115	4620	Re	No	9½	.....	105	Oil	Brown-Lipe	231
		6	6	.....	.....	.....	.....	6	Cl	3115	4620	Re	No	9½	.....	105	Oil	Brown-Lipe	232
Sp	Hl	6-8	7	.....	.....	.....	.....	6-8	Cl	4615	4620	Ce	Op	.....	.....	.....	Oil	Brown-Lipe	1431
Sp	Hl	6-8	6-8	7	7	.....	6-8	7	Cl	4615	4620	Ce	Op	.....	.....	.....	Oil	Brown-Lipe	2252
Sp	Hl	6-8	6-8	7	.....	7	6-8	7	Cl	4615	4620	Ce	Op	.....	.....	.....	Oil	Brown-Lipe	2253
		7-9	7-9	7	.....	.....	7-9	7	Cl	3115	4620	Ce	Op	.....	.....	127	Oil	Brown-Lipe	2341
Sp	Hl	6-8	6-8	7	7	.....	6-8	7	Cl	4615	4620	Ce	Op	8	2½	.....	Oil	Brown-Lipe	2352
Sp	Hl	6-8	6-8	7	.....	7	6-8	7	Cl	4615	4620	Ce	Op	.....	.....	.....	Oil	Brown-Lipe	2353
	Hl	6	.....	.....	.....	.....	.....	6	Cl	4615	4620	Ce	.....	.....	.....	135	Oil	Brown-Lipe	3221
	Hl	6	.....	.....	.....	.....	.....	6	Cl	4615	4620	Ce	.....	.....	.....	135	Oil	Brown-Lipe	3222
Sp	Hl	6-8	6-8	7	7	.....	6-8	7	Cl	4615	4620	Ce	.....	.....	.....	225	Oil	Brown-Lipe	3241
Sp	Hl	6-8	6-8	7	7	.....	6-8	7	Cl	4615	4620	Ce	Op	.....	.....	225	Oil	Brown-Lipe	3341
Sp	Hl	6-8	6-8	7	7	.....	6-8	7	Cl	4615	4620	Ce	Op	.....	.....	.....	Oil	Brown-Lipe	3352
Sp	Hl	6-8	6-8	7	.....	7	6-8	7	Cl	4615	4620	Ce	Op	.....	.....	.....	Oil	Brown-Lipe	3353
Sp	Hl	6-8	6-8	6-8	7	.....	6-8	7	Cl	4615	4620	Ce	Op	8	2½	225	Oil	Brown-Lipe	3440
Sp	Hl	.....	.....	.....	.....	.....	.....	.....	Cl	4615	4620	Ce	Op	.....	.....	360	Oil	Brown-Lipe	3481
Sp	Hl	6-8	7	.....	.....	.....	6-8	7	Al	4615	4620	Si	Op	.....	.....	.....	Oil	Brown-Lipe	5031
		6	.....	.....	.....	.....	.....	.....	Cl	4615	4620	Ce	.....	.....	.....	190	Oil	Brown-Lipe	5221
		.....	.....	.....	.....	.....	.....	.....	Cl	4615	4620	Ce	.....	.....	.....	190	Oil	Brown-Lipe	5222
Sp	Hl	6-8	6-8	6	.....	.....	6-8	6	Cl	4615	4620	Ce	Op	.....	.....	320	Oil	Brown-Lipe	5241
Sp	Hl	6-8	6-8	6	.....	6	6-8	6	Cl	4615	4620	Ce	Op	.....	.....	410	Oil	Brown-Lipe	5251
Sp	Hl	6	6	.....	.....	.....	6-8	6	Cl	4615	4620	Si	Op	.....	.....	.....	Oil	Brown-Lipe	5331
Sp	Hl	6-8	6-8	6	.....	.....	6-8	6	Cl	4615	4620	Ce	Op	.....	.....	320	Oil	Brown-Lipe	5341
Sp	Hl	6-8	6-8	6	.....	6	6-8	6	Cl	4615	4620	Ce	Op	.....	.....	410	Oil	Brown-Lipe	5351
Sp	Hl	6-8	6-8	6-8	6	.....	6-8	6	Cl	4615	4620	Ce	Op	.....	.....	410	Oil	Brown-Lipe	5352
Sp	Hl	6-8	6-8	.....	.....	.....	6-8	6	Cl	4615	4620	Ce	Op	.....	.....	320	Oil	Brown-Lipe	5440
	Hl	5	.....	.....	.....	.....	.....	6	Cl	4615	4620	Ce	No	.....	.....	200	Oil	Brown-Lipe	6031
Sp	Hl	6-8	6	6	.....	.....	6-8	6	Al	4615	4620	CS	Op	.....	.....	.....	Oil	Brown-Lipe	7131
Sp	Hl	5-7	5-7	6	.....	.....	5-7	6	Cl	4615	4620	Ce	Op	.....	.....	480	Oil	Brown-Lipe	7241
Sp	Hl	5-7	5-7	6	.....	.....	5-7	6	Cl	4615	4620	Ce	Op	.....	.....	480	Oil	Brown-Lipe	7341
Sp	Hl	5-7	5-7	6	.....	6	5-7	6	Cl	4615	4620	Ce	Op	.....	.....	580	Oil	Brown-Lipe	7351
Sp	Hl	5-7	5-7	.....	6	.....	5-7	6	Cl	4615	4620	Ce	Op	.....	.....	480	Oil	Brown-Lipe	7440
	Hl	6	.....	.....	.....	.....	.....	6	Cl	3115	4620	Re	No	9½	3	105	Oil	Brown-Lipe	2321
	Hl	6-8	.....	.....	.....	.....	.....	6-8	Cl	3115	4620	Re	No	9½	3	105	Oil	Brown-Lipe	2323
	Hl	6-8	6-8	7	.....	.....	.....	7	Cl	3115	4620	CR	Op	9½	3	168	Oil	Brown-Lipe	2441
Hl	Hl	6-8	6-8	7	7	.....	6-8	7	Cl	3115	4620	CR	Op	9½	3	175	Oil	Brown-Lipe	2452
	Hl	6-8	6-8	7	.....	.....	7	7	Cl	3115	4620	CR	Op	9½	3	175	Oil	Brown-Lipe	2453
Sp	Sp	Var	Var	Var	Var	Var	Var	Var	Cl	4620	Var	CR	No	Yes	.....	Var	Oil	Clark	170FS
Sp	Sp	.....	.....	.....	.....	.....	.....	.....	Cl	4620	VMAS	Ce	No	.....	.....	Var	Oil	Clark	B-300
Sp	Sp	.....	.....	.....	.....	.....	.....	.....	Cl	4620	VMAS	Ce	No	.....	.....	Var	Oil	Clark	301
Sp	Hl	.....	.....	.....	.....	.....	.....	.....	Cl	4620	4620°	Ce	No	.....	.....	Var	Oil	Clark	185-F
Sp	Hl	.....	.....	.....	.....	.....	.....	.....	Cl	Spec	Spec	Ce	No	.....	.....	Var	Oil	Clark	200-V
Sp	Hl	.....	.....	.....	.....	.....	.....	.....	Cl	Spec	Spec	Ce	No	.....	.....	Var	Oil	Clark	200-VO
Sp	Hl	Var	Var	Var	Var	Var	Var	Var	Cl	4620	Var	CFR	No	Yes	.....	Var	Oil	Clark	202-V
Sp	Hl	Var	Var	Var	Var	Var	Var	Var	Cl	4620	Var	CFR	No	Yes	.....	Var	Oil	Clark	202-VO
Sp	Hl	Var	Var	Var	Var	Var	Var	Var	Cl	4620	Var	FR	No	Yes	.....	Var	Oil	Clark	230-F
Sp	Hl	Var	Var	Var	Var	Var	Var	Var	Cl	4620	Var	FR	No	Yes	.....	Var	Oil	Clark	231-F
Sp	Hl	.....	.....	.....	.....	.....	.....	.....	Cl	4620	4620°	FR	No	.....	.....	Var	Oil	Clark	270-V
Sp	Hl	.....	.....	.....	.....	.....	.....	.....	Cl	Spec	Var	FR	No	.....	.....	Var	Oil	Clark	270-VO
Sp	Hl	.....	.....	.....	.....	.....	.....	.....	Cl	4620	4620°	Ce	No	.....	.....	Var	Oil	Clark	325-VO
Sp	Hl	Var	Var	Var	.....	.....	.....	.....	Cl	4620	Var	Ce	No	7	2	Var	Oil	Clark	140-T
Sp	Hl	Var	Var	Var	Var	Dir	.....	.....	Cl	4620	Var	Ce	No	No	No	Var	Oil	Clark	187-F
Sp	Hl	Var	Var	Var	Var	Dir	Var	Var	Cl	4620	Var	Ce	No	9½	3	Var	Oil	Clark	204-V
Sp	Hl	Var	Var	Var	Dir	.....	Var	Var	Cl	4620	Var	CFR	No	9½	3	Var	Oil	Clark	204-VO
Sp	Hl	Var	Var	Var	Var	Dir	Var	Var	Cl	4620	Var	CFR	No	10½	3	Var	Oil	Clark	272-V
Sp	Hl	Var	Var	Var	Dir	.....	Var	Var	Cl	4620	Var	CFR	No	10½	3	Var	Oil	Clark	272-VO
Sp	Hl	Var	Var	Var	Var	Dir	Var	Var	Cl	4620	Var	CR	No	Yes	.....	Var	Oil	Clark	326-V
Sp	Hl	Var	Var	Var	Dir	.....	Var	Var	Cl	4620	Var	CR	No	Yes	.....	Var	Oil	Clark	326-VO
Sp	.....	.....	.....	.....	.....	.....	.....	.....	SS	3120°	3120	Ce	Op	.....	.....	165	NoF	Cotta	A
Sp	.....	.....	.....	.....	.....	.....	.....	.....	SS°	3120°	3120	.....	Op	.....	.....	575	NoF°	Cotta	FA
Sp	.....	.....	.....	.....	.....	.....	.....	.....	SS	3120°	3120	.....	Op	.....	.....	250	NoF	Cotta	FAA
Sp	.....	.....	.....	.....	.....	.....	.....	.....	SS	3120	3120	Si	Op	.....	.....	150	NoF	Cotta	JR
Sp	.....	.....	.....	.....	.....	.....	.....	.....	SS	3120°	3120	Ce	Op	.....	.....	250	NoF	Cotta	RAU
Sp	.....	.....	.....	.....	.....	.....	.....	.....	SS	3120°	3120	Ce	Op	.....	.....	325	NoF	Cotta	SAU
Sp	.....	.....	.....	.....	.....	.....	.....	.....	SS	3120°	3120	Ce	Op	.....	.....	400	NoF	Cotta	TAU
Sp	.....	.....	.....	.....	.....	.....	.....	.....	SS	3120°	3120	.....	Op	.....	.....	410	NoF	Cotta	T
Sp	.....	.....	.....	.....	.....	.....	.....	.....	SS	3120°	3120	.....	Op	.....	.....	210	NoF	Cotta	TS
Sp	.....	.....	.....	.....	.....	.....	.....	.....	SS	3120°	3120	.....	Op	.....	.....	325	NoF	Cotta	ZA
Sp	Sp	5-7	5-7	5-7	5-7	5-7	5-7	5-7	SS	2340	2320	FR	No	No	No	.....	Oil	Cotta Gear	55
Sp	Sp	6-8	6-8	6-8	6-8	6-8	6-8	7-9	SS	2340	2320	Ce	No	No	No	.....	Oil	Cotta Gear	45-U
Sp	Sp	5-7	5-7	5-7	5-7	5-7	5-7	5-7	SS	2340	2320	FR	No	No	No	.....	Oil	Cotta Gear	65
	Sp	4½	5	5	.....	.....	.....	5	Cl	(e)	(f)	Re	No	No	No	340	Oil	Fuller	3-A-86
	Sp	6-6.9	6	.....	.....	.....	.....	6	Cl	(e)	(g)	Re	No	No	No	158	Oil	Fuller	2-A-53
	Sp	6-6.9	6	.....	.....	.....	.....	6	Cl	(e)	(g)	Re	No	No	No	158	Oil	Fuller	2-A-53
	Hl	5-6	6-6.5	.....	.....	.....	.....	6-6.5	Cl	(e)	(h)	Re	No	No	No	120	Oil	Fuller	AR-1.63
Sp	Hl	6-6.5	.....	.....	.....	.....	5-6	6-6.5	Cl	(e)	(i)	Re	No	No	No	120	Oil	Fuller	AR
	Hl	5-6	6-6.5	.....	.....	.....	.....	6-6.5	Cl	(e)	(h)	Rr	No	No	No	150	Oil	Fuller	UR-1.63
Sp	Hl	6-6.5	.....	.....	.....	.....	5-6	6-6.5	Cl	(e)	(i)	Rr	No	No	No	150	Oil	Fuller	UR
Sp	Sp	4½-6	4½-6	4½-6	6-8	.....	4½-6	6-8	Cl	(k)	2512	Ce	Op	No	No	315	Oil	Fuller	MHU
	Sp	4½-6	6-8	.....	.....	.....	.....	6-8	Cl	.....	.....	Ce	Op	No	No	135	Oil	Fuller	2SC-2.75
Sp	Hl	6-7	6-7	7-9	7-9	7-9	6-7	7-9	Cl	(m)	(n)	CR	Op	8°	2½°	210	Oil	Fuller	5-A-33 & 5-B-33
Sp	Hl	6-7	6-7	7-9	7-9	7-9	6-7	7-9	Cl	(m)	(n)	CR	Op	8°	2½°	210	Oil	Fuller	5-A-330 & 5-B-330
Sp	Hl	6-7	6-7	7-9	7-9	7-9	6-7	7-9	Cl	(m)	(n)	F	No	8°	2½°	220	Oil	Fuller	5-F-33 & 5-9-33
Sp	Hl	6-7	6-7	7-9	7-9	7-9	6-7	7-9	Cl	(m)	(n)	F	No	8°	2½°	220	Oil	Fuller	5-F-330 & 5-G-330
Sp	Hl	6-7	6-7	6-6.9	6-6.9	6-6.9	6-7	6-6.9	Cl	(m)	(n)	CR	Op	10	3	330	Oil	Fuller	5-A-43
Sp	Hl	6-7	6-7	6-6.9	6-6.9	6-6.9	6-7	6-6.9	Cl	(m)	(n)	CR	Op	10	3	330	Oil	Fuller	5-A-430
Sp	Hl	5-6	5-6	6-6.5	6-6.5	6-6.5	5-6	6-6.5	Cl	(m)	(n)	CR	Op	.....	.....	370	Oil	Fuller	5-A-62
Sp	Hl	5-6	5-6	6-6.5	6-6.5	6-6.5	5-6	6-6.5	Cl	(m)	(n)	CR	Op	.....	.....	370	Oil	Fuller	5-A-620
	Cs	7	7	.....	.....	.....	.....	7	Cl	6145	6145	Re	No	No	No	.....	Oil	Mann	B
He	He	7	7	7	7	.....	7	7	Cl	2315	2315	CR	No	No	No	.....	Oil	Mann	200
Sp	Sp	5	5	5	5	.....	5	5	Cl	2315	2315	CR	No	No	No	380	Oil	Man	U-300
Sp	Sp	5	5	5	5	.....	5	5	Cl	2315	2315	FR	No	No	No	265	Oil	Mann	M-300
He	He	6	6	6	6	.....	6	6	Al	2315	2315	CR	No	No	No	286	Oil	Mann	600
He	He	6	6	6	6	.....	6	6	Al	2315	2315	CR	No	No	No	285	Oil	Mann	600 Ov.
Sp	Hl	7	7.9	7.9	.....	.....	7.3	7.9	Cl	4620	4620	CF	No	7	2	73	Oil	New Process	36280
Sp	.....	7-9	7	7	.....	.....	7-9	7	Cl	5140	5140	CF	No	7	2	117¾	Oil	New Process	36300
Hl	.....	9.25	9.25	.....	.....	.....	9.25	9.25	Cl	3120	M-CM	Ce	No	7	2½	*145¾	Oil	Warner Gear	T85&T85A
Sp	.....	8.2	11-NP	.....	.....	.....	8.2	11-NP	Cl	ML-CM	4640	Ce	No	No	No	45¾	Oil	Warner Gear	T-84D
Sp	.....	9.25	9.25	..	.....	.....	8	8	Cl	M-CM	ML-CM	Ce	Yes	6	2	88	Oil	Warner Gear	T-83
Hl	.....	8-7	9.25	.....	.....	.....	8-7	9.25	Cl	4615	4640	Ce	No	No	No	108	Oil	Warner Gear	T-82A
Sp	.....	7	7	7-9	.....	.....	7-9	7-9	Cl	M-CM	4620	Ce	Op	8	2°	131	Oil	Warner Gear	T-9A
Sp	.....	7	7	7-9	.....	.....	7-9	7-9	...	M-CM	M-CM	Ce	Op	8	2°	139	Oil	Warner Gear	T-9
Hl	.....	9.34	9.43	.....	.....	.....	9.34	10.59	Cl	3120	4620	Ce	No	No	No	84	Oil	Warner Gear	T-86A
Hl	.....	9.34	9.43	.....	.....	.....	9.34	10.59	Cl	3120	4620	Ce	No	No	No	90‡	Oil	Warner Gear	T-88

ABBREVIATIONS:

°—Others also
*—With R1 overdrive unit
**—With R7 overdrive unit
(a)—Low 7.88. High 4.37
(b)—Low 7.00. High 3.90
(c)—Low 8.05. High 4.07
(d)—Low 6.51. High 3.29
(e)—Mainshaft 4620-3 Countershaft 2320
(f)Mainshaft Overdrive Gear 2512. All Others 2320
(g)—Countershaft, Low 2512 All Others 2320
(h)—Low 2512. Others 4620
(j)—Reverse 2512. All Others 4620
(k)—Mainshaft 2320 Countershaft 2512
(m)—Mainshaft 4620-3 Countershaft 2512
(n)—Helical Gears 4620 Spur 2320 and 2512
(p)—High 4.71. Low 8.00
(r)—High 3.33. Low 6.50
(s)—High 4.74. Low 8.12
(t)—High 3.55. Low 7.11
BB—Bronze Bushing
B&G—Ball, and Reverse Roller Shaft or Gear
B&R—Ball and Roller
C—Cars
C&C—Constant Mesh and Clash
Ce—Center
CF—Center Forward
CFR—Center, forward and remote
Ch—Constant Mesh, Helical
CI—Cast Iron
CM—Chrome Manganese Steel
Con—Constant Mesh
CR—Center and Remote
Cs—Constant Mesh, Spur
CS—Center or Side
Csy—Constant Mesh, Synchronizing Clutches
Dir—Direct
F—Forward
FR—Forward or remote
G-T—Gear Teeth
He—Herringbone
Hl—Helical
NoF—Non-Fluid
Op—Optional
Re—Remote
Rol—Roller
Rr—Rear
Si—Side
Sp—Spur
Spec—Special
SS—Semi-Steel
T—Trucks
Tr—Tractors

and reverse gears, which have to transmit the greatest pitchline loads. Most of the gears for the higher forward speeds, on the other hand, have single pitch numbers and are of the full-depth type, which are preferred for these trains because of their more quiet operation. This advantage of the full-depth tooth is of no great importance in the case of the low-forward and reverse gears, because these are used for short periods only, and their pitch-line velocity is lower.

A large majority of the direct-drive clutches are of the gear-tooth type.

The synchronized-shift transmission evidently is not being used on commercial vehicles to any extent as yet; only one of the stock transmissions here listed as offered for use on trucks, buses and tractors, has synchronizing mechanisms.

Torque ratings are not given for the transmissions. The torque capacity of a transmission, of course, is bound up with its service life and is, therefore, not such a definitely limited factor as the horse power of an engine, for instance. Where the power is transmitted through the transmission gears a large part of the time and the vehicle is expected to have a long life, a greater factor of safety must be figured with than in the opposite case, and the torque load reduced correspondingly.

There is naturally some relation between the distance between axes of main and countershaft bearings and the pitches used, as the largest transmissions have gears of coarse pitch. In the following, what is meant by "pitch" of the countershaft gears is the normal diametral pitch. One transmission is listed with a diametral pitch of 8, and its center distance is only 2.93 in. In transmissions having a normal diametral pitch of 7 the average center distance is 4.57 in.; with 6 pitch it is 5.66 in., and with 5 pitch (of which there are only relatively few examples), it is 5.70 in.

Cast iron housings are almost universal. Two makers use semi-steel (high-test cast iron) for the housings, while another offers two models with aluminum housings.

Alloy steels of the low-carbon or case-hardening type are used almost exclusively for shafts, the three most popular grades being chrome-nickel-molybdenum (4615 or 4620), chrome-nickel (3115 or 3120) and nickel steel (2315). In one or two cases medium carbon steels are used. The 5 per cent nickel steel (2512) is also used to a certain extent. These same (that is, case-hardening) steels are also used for the gears, though one maker uses the chrome-nickel-molybdenum, medium-carbon steel No. 4640, which is hardened by cyaniding.

The majority of these transmissions have oil lubrication.

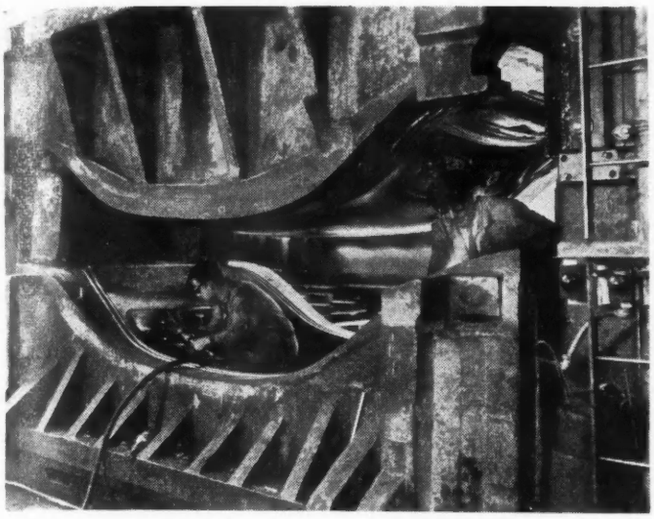
Statistical Issue of AUTOMOTIVE INDUSTRIES Nears Its 20th Anniversary

FEBRUARY 26, 1938, signifies to us and to thousands of subscribers throughout the automotive industry, publication of the twentieth consecutive edition of the annual statistical issue of AUTOMOTIVE INDUSTRIES.

About this time of the year, our foreign mail, always interesting and voluminous, grows to colossal proportions . . . bringing back bulky questionnaires sent weeks ago to manufacturers of engines, automobiles, and aircraft in the far corners of the world. From the domestic side of the industry, the normal day's mail is swollen by similar bulky envelopes containing the complete details of hundreds of automotive products. Our statistical department begins to get red-eyed and all of us on the staff share a certain tension which tightens as the issue date approaches. It's our big job of the year, and we love it.

This year, it is evident that much more statistical and specifications material will be available than can be conveniently included within the covers of a single issue. The transmission material printed herewith was ready in advance, so we decided to give it to you in advance of the Statistical Issue in which it would normally appear. Other material of similar character will precede (and follow) appearance of the Statistical Issue proper. The issue itself will be built around specifications of the fundamental vehicles . . . passenger cars, trucks, buses, tractors, etc. It will contain, for example, important and complete revisions of the comprehensive passenger-car specifications published in our issue of Oct. 23.

Such a program will, we believe, offer maximum service to the reader. Advance material will be printed as it is ready. The Statistical Issue will continue to be the fundamental reference book it has always been, and we shall be able to give more time to the finishing touches on late material.



Production Lines

In the above picture, workmen are shown inside the jaws of a press more than 12½ feet wide, smoothing off rough spots to correct high spots on an inlay. These presses exert 3,000,000 pounds of pressure in turning out DeSoto tops.

Much Springs

One of the engineering departments was kind enough to make a thorough check of body weights for us recently. They were quite as surprised as your own editor to find that the weight of seat springs, alone, was 75 pounds. Considering the fact that this was a rather moderately-priced car, the figure of 75 pounds sounds rather good, but then we must confess that we don't know how other cars stock up in this respect.

Barrel Engine

Over the years there have been a number of round or barrel engines under development. During Show Week back East, we met a man who claims to have the problem thoroughly licked not only engineering-wise but from the standpoint of real financial backing. The engine is very small and compact for the job it does; it can be built for gasoline or Diesel fuel; and it can be made two-cycle or four-cycle. At least that's the story as we get it first hand.

Fool Proof

The American Standards Association has issued its standard safety code for power presses and foot and hand presses (B11-1937). According to a statement made by the ASA, this standard has been adopted by the states of Pennsylvania, Maryland, and New Jersey. In addition, the following states are said to use the standard as a basis for industrial regulations—Wisconsin, Iowa, Nebraska, Ohio, Oklahoma, Oregon.

Electric Power

Those who have studied the statistics of the electrical power capacity of current passenger cars will realize that while the industry has made the biggest advances in many years, there still remains a pretty close balance between output and energy demand. Straws blowing in the wind intimate that we are at the threshold of some important developments. It's not unlikely that something will be done to boost generator and battery capacity much higher and thus produce a bigger margin between desired and available energy. In all probability this move will be imperative if and when there is a general trend to higher headlamp wattages.

Precision Jobs

The last word in machine shop practice around Detroit is the use of special precision set-ups for single-point boring and facing; also special precision indexing for holes that have to be held "dead on the nose." Special equipment and tooling for the purpose make it commercially possible to produce tolerances that seem like watch-making at first glance.

Tell Owners

Talking with some engineers on a recent swing around the circuit we came upon an idea that is well worth passing on. Selling the new cars by demonstration is admittedly the only good answer today. However, when the sale is clinched there is a big gap that seems to have been overlooked. We refer to the special features of the car that require at least some explanation so that the owner may have the benefit of the things that engineers have worked so hard to incorporate in the car. It may be the Olds or Buick automatic transmission. The owner should know how to get the most out of it. Or it may be in connection with one of the cars with overdrive. Studebaker, for example, has free-wheeling in combination with overdrive and the Evans shifter. How many people know that this combination may be used invariably if one takes advantage of second speed overdrive for passing or maximum acceleration on heavy grades. There must be many other items of similar nature, simple to be sure, but of great importance to an owner—and major elements in owner satisfaction.

Job Lot

We have just returned from a visit to an old line engine builder whose product is so varied that production is confined exclusively to job-lot set-ups. Yet by careful planning they have found it possible to combine universal fixtures with flexible machine tools in such fashion as to do the most economical job at exceptionally high quality levels. The point of the story is that there are many more plants of this type, numerically, than of those that have exclusively mass-production. Herein lies an exceptional opportunity for machine tool builders to render service by anticipating the needs of producers of this type and making available the universality and flexibility that may place job-lot manufacturing on a more even plane with mass production.—J. G.

Herrmann Barrel-Type Engine

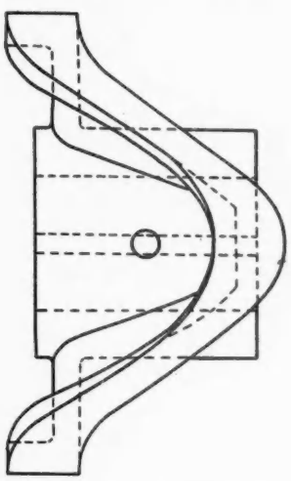
(Continued from page 903)

similar to it in some other respects. The valves, for instance, have the same dimensions and are timed the same, and the ignition unit shown at the left-hand side is of the type which has become familiar through its use on Ford and Lincoln Zephyr cars. These design features are due to a desire to eliminate the need for experimental development of these details.

With a cast-iron cylinder block, cylinder head, and exhaust manifold, this 12-cylinder 333-cu. in. engine weighs 384 lb. without carburetor or water pump, or about 1.16 lb. per cu. in. displacement. If the cylinder blocks and cylinder heads are cast of aluminum alloy and provided with standard-type cylinder liners and valve-seat inserts, and the exhaust manifold is made of tubing instead of in the form of a casting, the weight can be reduced to 216 lb., or about 1½ lb. per hp.

When following normal automobile practice by making the cylinder blocks and other large parts of the engine of cast iron, it is figured that the manufacturing cost would be only about 50 per cent that of the conventional engine of equal displacement, while if aluminum alloy were used for the principal parts and the engine lightened in other ways, the production cost probably would run some 75 per cent that of the conventional automotive design.

Aside from its lightness, compactness and simplicity, this new design offers the advantage that the motion of the pistons and other reciprocating parts is a true harmonic motion, and there are no unbalanced secondary or higher harmonics. In fact, the reciprocating parts taken together are completely balanced. Also, there seems to be no possibility of torsional vibration with an engine of this design.



Details of the Cam Plate

We understand that Mr. Herrmann is in position to furnish sample engines to concerns that may be interested, and to render a consulting service to those who are in position to build their own engines.

Mechanics' new slip joint weighs less than other designs — about two pounds less. Metal is removed from the center, that which remains is most effectively distributed, and is machined all over for best balance. There are more splines on the increased diameter. This results in lower unit pressures, better lubricating conditions, permits machining after heat treating, improving accuracy, resulting in better working, smoother running a more comfortable ride.

Mechanics Universal Shaft Assemblies with the new slip joint have many other advantages viz., integral keys, ground pilots, accurate machining, hardened and ground surfaces for end thrust, and many other characteristics which promote smooth operation. Use Mechanics Universal Joints and Shaft Assemblies for reliable power transmission, satisfactory operation, and economy.

MECHANICS UNIVERSAL JOINT DIVISION
Borg-Warner Corp. 1301 18th AVE., ROCKFORD, ILLINOIS

Continental Aircraft Engine

(Continued from page 906)

Exhaust-port outlets are at the top of the engine, which permits of directing the exhaust manifold over the wing of a high-wing plane, to keep exhaust gases out of the cabin and reduce cabin noises. An alternate exhaust system consists of downpipes at the rear of the engine, joined to a single outlet to produce a uniform exhaust sound, if that is desired.

ngineering
Library

DEC 13 1937

AUTOMOTIVE INDUSTRIES

LAND — AIR — WATER

DECEMBER 11, 1937

STRAIGHT-LINE STEERING IN EMERGENCIES

PROTECTION FROM BLOW-OUT HAZARDS
with the
BENDIX HYDRAULIC STEERING STABILIZER

Bendix Hydraulic Steering Stabilizer banishes the dread of blow-out disaster. Quickly installed on any vehicle with either conventional or "knee action" type of suspension—car, truck or bus. Makes it virtually impossible for a sudden road shock to wrest control from the driver. A blow-out or the striking of a rock, a log or an ordinary curbing, has no effect on the course of the car. It continues straight ahead, or may be steered readily, just as the driver wishes.

BENDIX AVIATION CORPORATION
CHICAGO · SOUTH BEND · NEW YORK

BENDIX

RED RING

SHAVED GEARS ARE ALWAYS

UNIFORM

Gear tooth shaving is basically the reduction of rough cut gears to a common denominator.

Red Ring shaving corrects not only the dimensional errors in gear tooth profile, but it removes surface roughness and washboard effect.

Notwithstanding the advantages in gear uniformity and the quietness of gear operation thus attained, rotary shaving is less expensive than other methods of finishing. It is a regular production operation requiring only from 20 to 40 seconds per unit processed.

"Modern Methods of Gear Manufacture", a comprehensive treatment of this subject is available to production and engineering executives.

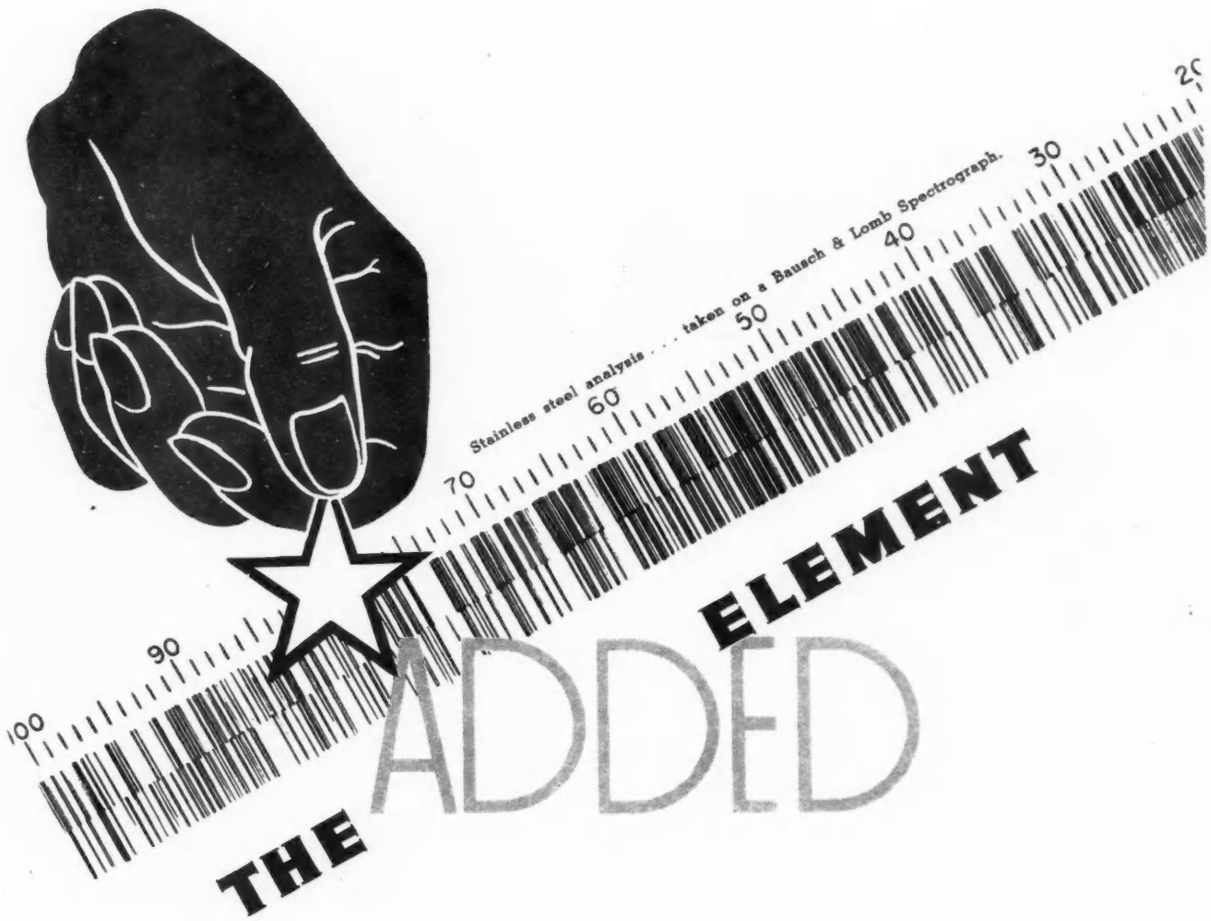
Patents applied for and issued: 1989650; 1989651; 1989652

Write for descriptive literature

NATIONAL BROACH & MACHINE COMPANY

Shoemaker & St. Jean

Detroit, Michigan



★ In the Stainless Steel produced by Rustless there is an *added* element. It is not shown by spectrograph analysis, but by the revealing test of use. The presence of this element is recognized by every customer. It is *quality*.

This quality is present in all Rustless Bars and Wire because the organization, concentrating exclusively on making stainless steel, can concentrate on making it better. What this added element has done for others, it can do for you.

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RUSTLESS
CORROSION AND HEAT-RESISTING
STAINLESS STEELS

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Pacific Greyhound Lines

All City Companies
Kansas City Public Service Co.

BUS
TRANSPORTATION
MAINTENANCE AWARD
PRESENTED ANNUALLY BY THE MAGAZINE BUS TRANSPORTATION FOR COMPLETENESS AND EFFICIENCY IN MAINTENANCE METHODS AND PRACTICE
GOLD AWARD 1937
ALL CITY COMPANIES WON BY KANSAS CITY PUBLIC SERVICE CO. KANSAS CITY, MISSOURI
AWARD 1937

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Peerless Stages, Inc.

Class B—City Companies
The Wichita Transportation Corp.

They all use Ross

All four winners of the annual Bus Transportation Maintenance Awards use Ross Steering. There could be no better evidence of the economy and dependability which the exclusive cam and lever principle contributes to modern steering.
Ross Gear and Tool Company, Lafayette, Indiana

ROSS CAM & LEVER STEERING

Upon FACT

Photograph by H. Armstrong Roberts

The fact is that 85% plus of the business done in the automotive retail-wholesale field is transacted by readers of Automobile Trade Journal, Motor Age and Motor World Wholesale — the Chilton "Merchandising Trio".

Eighty-five per cent plus of the money that circulates in these branches of the automotive industry passes, governed by the judgment, knowledge, belief of Chilton readers. To exert your influence upon that nearly-all of automotive after-market business, these Chilton Publications provide such precise, economical means as have never before been offered.

By precise, we mean that you may influence any or all of the three divisions of the automotive after-market — car dealers, maintenance men, and wholesalers, as you choose. By economical, we mean that you may influence any division at a fraction of the cost of formerly doing so.

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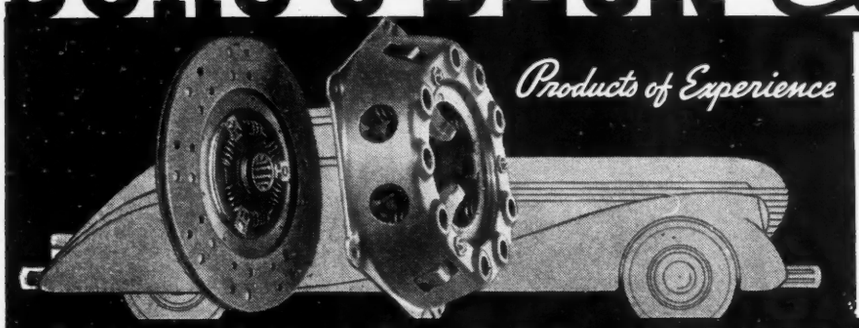
This constitutes the Chilton unmatched and unmatchable advertising package for automotive manufacturers — precision and economy in their highest degree.

CHILTON COMPANY

Chestnut & 56th Streets, Philadelphia, Pa.

BORG & BECK *Clutches*



You Can Count on Them

DIVISION OF BORG-WARNER CORPORATION

◆ BUYERS' GUIDE ◆

Automotive Products and Factory Equipment Manufactured by Advertisers in This Issue

See Alphabetical List of Advertisers on page 43

This Advertisers' Index is published as a convenience, and not as part of the advertising contract. Every care will be taken to index correctly No allowance will be made for errors or failure to insert.

Alloys
Carnegie-Illinois Steel Corp., U. S. Steel Corp. Subsidiary
Non-ferrous
Aluminum Co. of America
Dow Chemical Co. (Magnesium)

Arms & Knuckles, Steering
Atlas Drop Forge Co.

Auto Body Panels
Metal Auto Parts Co., Inc.

Axles
Atlas Drop Forge Co.
Spicer Mfg. Co.
Union Drawn Steel Co. (Cold Drawn)

Belting, Metal, Conveyor High & Low Temperature
Wickwire Spencer Steel Co.

Blanks
Atlas Drop Forge Co. (Forged)
Wyman, Gordon Co.

Boring Machines
Baker Brothers, Inc.

Brake Strands
Wickwire Spencer Steel Co.

Brake Testers
Bendix Products Corp.

Brakes
Emergency
American Cable Div. American Chain & Cable Co., Inc. (Automotive Division)
Hydraulic
Bendix Products Corp.
Power
Bendix Products Corp.

Broaches
National Broach Machine Co.

Camshafts
Atlas Drop Forge Co.

Carburetors
Bendix Products Corp.

Castings
Aluminum
Aluminum Co. of America
Steel
Carnegie-Illinois Steel Corp., U. S. Steel Corp. Subsidiary

Chains, Tire
American Cable Div. American Chain & Cable Co., Inc. (Automotive Division)

Channels for Glass
Felt
American Felt Co.

Clamps, Hose (Adjustable)
Wittek Mfg. Co.

Cleaners
Metal
American Chemical Paint Co. (Rust Preventive)

Clutches
Borg & Beck Co. (Division of Borg-Warner Corp.)
Long Mfg. Division Borg-Warner Corp.
Spicer Mfg. Corp. (Automatic)

Connecting Rods
Aluminum Co. of America
Atlas Drop Forge Co.
Wyman-Gordon Co.

Controls
Choke (Automatic)
Bendix Products Corp.
Clutch (Automatic)
Bendix Products Corp.

Cowls
Metal Auto Parts Co., Inc.

Crankshafts
Atlas Drop Forge Co.
Union Drawn Steel Co.
Wyman-Gordon Co.

Cutters
Baker Brothers, Inc. (Keyseaters)

Cylinder Heads
Aluminum Co. of America

Degreasing Machines
G. S. Blakeslee & Co.

Die Making Machine
Wittek Mfg. Co.

Discs, Clutch
Borg & Beck Co. (Division of Borg-Warner Corp.)

Drill Presses
Delta Mfg. Co.

Drilling Machines
Baker Brothers, Inc.

Drives
Bendix Products Corp.
Eclipse Machine Co. (Starter)

Drop Forgings
Aluminum Co. of America
Atlas Drop Forge Co.

Dust Shields
Metal Auto Parts Co., Inc.

Feeds, Rail for Punch Presses
Wittek Mfg. Co.

Felt
American Felt Co.

BUYERS' GUIDE—Continued

Fenders
Metal Auto Parts Co., Inc.

Filing Machines
Wittek Mfg. Co.

Filters, Gasoline
Zenith Carburetor Co., Subsidiary of Bendix Aviation Corp.

Forgings
Carnegie-Illinois Steel Corp., U. S. Steel Corp. Subsidiary
Wyman-Gordon Co.

Furnaces
Electric
American Bridge Co., U. S. Steel Corp. Subsidiary

Gaskets
Felt
American Felt Co.

Gear Material (Non-Metallic)
General Plastics, Inc.

Grease Seals & Retainers
Chicago Rawhide Mfg. Co.

Heat Treating
Barnes Co., Wallace, Div. of Associated Spring Corp.
Barnes-Gibson-Raymond Div. of Associated Spring Corp.
Gibson Co., Wm. D., Div. of Associated Spring Corp.

Hoods
Metal Auto Parts Co., Inc.

Hotels
Hotel Biltmore
Albert Pick Hotels (Miami Hotel)

Insulating Materials
General Plastics, Inc.

Instrument Panels
Metal Auto Parts Co., Inc.

Keyseaters
Baker Broters, Inc.

Lathes
Automatic Chucking
Potter & Johnston Machine Co.
Turret
Potter & Johnston Machine Co.

Leather Goods, Mechanical
Chicago Rawhide Mfg. Co.

Leather Parts, Boots & Straps
Chicago Rawhide Mfg. Co.

Lighting Units
Fostoria Pressed Steel Corp.

Machines
Gear Shaving
National Broach & Machine Co.

Materials, Molding (Phenolic)
General Plastics Co.

Metal Washing Machines
G. S. Blakeslee & Co.

Milling Machines
Potter & Johnston Machine Co.

Molded or Machined Parts (Phenolic)
General Plastics, Inc.

Motor Pans
Metal Auto Parts Co., Inc.

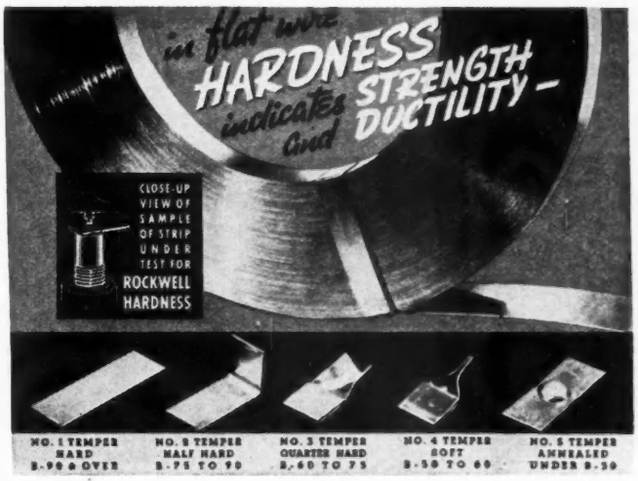
Oils
Rust Preventing
American Chemical Paint Co.

Packings
Leather
Chicago Rawhide Mfg. Co.

Pads
Felt
American Felt Co.

Paint Pretreatments
American Chemical Paint Co.

(Turn to page 40, please)


in flat wire
HARDNESS
indicates
STRENGTH
and
DUCTILITY—
CLOSE-UP VIEW OF SAMPLE OF STRIP UNDER TEST FOR ROCKWELL HARDNESS
NO. 1 TEMPER HARD B-90 & OVER
NO. 2 TEMPER HALF HARD B-75 TO 90
NO. 3 TEMPER QUARTER HARD B-60 TO 75
NO. 4 TEMPER SOFT B-30 TO 60
NO. 5 TEMPER ANNEALED UNDER B-30

THE above Hardness Figures indicate Rockwell B Scale tests.

The relation between temper numbers, description and Rockwell readings are frequently altered to conform to tempers or thicknesses consistent with various existing specifications.

Physical properties of Cold Rolled Strip or Flat Wire are measured by hardness . . . the ability to resist indentation, rather than by breaking load. Strip used for deep drawing or severe bending must be extremely ductile and is indicated by a low Rockwell reading. On the other hand, clock spring steel must show a high reading as proof of its tensile strength and stiffness. Proper hardness of Flat Wire is vital to its satisfactory functioning. In the Wickwire Spencer Mills all Strip is thoroughly tested for hardness. From records of constant tests we know the proper Rockwell reading of Flat Wire best for your purpose. Write us and we will gladly advise you.

Wickwire Spencer manufactures High and Low Carbon Wires—in various tempers, grades and finishes—for your specific purpose. Hard-Drawn, soft or annealed Basic or Bessemer Wires—Hard-Drawn annealed, or oil-tempered Spring Wire, Chrome Vanadium Spring Wire—Valve Spring—Music—Clip—Pin—Hairpin—Hook and Eye—Broom—Stapling—Bookbinding—Dent Spacer Wire—Reed Wire—Clock—Pinion—Needle-Bar—Screw Stock—Armature Binding — Brush — Card—Florist—Mattress—Shaped—Rope—Welding. Flat Wire and Strip Steel, High or Low Carbon—Hard, annealed or tempered—Clock Spring Steel—Corrosion and Heat Resisting Wires.

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DETROIT REPRESENTATIVE:
CRAINE-SCHRAGE STEEL CO.
6189 Hamilton Avenue

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DETROIT, MICHIGAN ..... TULLER HOTEL
DAYTON, OHIO ..... MIAMI HOTEL
COLUMBUS, OHIO ..... CHITTENDEN HOTEL
COLUMBUS, OHIO ..... FORT HAYES HOTEL
TOLEDO, OHIO ..... FORT MEIGS HOTEL
CINCINNATI, OHIO .. FOUNTAIN SQUARE HOTEL
CANTON, OHIO ..... BELDEN HOTEL
SOUTH BEND, INDIANA ..... OLIVER HOTEL
INDIANAPOLIS, INDIANA ..... ANTLERS HOTEL
ANDERSON, INDIANA ..... ANDERSON HOTEL
TERRE HAUTE, INDIANA . TERRE HAUTE HOUSE
ASHLAND, KENTUCKY ..... VENTURA HOTEL
OWENSBORO, KENTUCKY . OWENSBORO HOTEL
JACKSON, TENNESSEE . NEW SOUTHERN HOTEL
ST. LOUIS, MO. ..... MARK TWAIN HOTEL
WACO, TEXAS ..... RALEIGH HOTEL
PICK HOTELS
WHENEVER YOU SEE THE WORD PICK THINK OF ALBERT PICK HOTELS

BUYERS' GUIDE *(Continued from page 39)*

Paints
Aluminum
Aluminum Co. of America
Heat Resisting
American Chemical Paint Co.

Perforated Metal
Wickwire Spencer Steel Co.

Pistons
Aluminum Co. of America

Radiators
Long Mfg. Division Borg-Warner Corp.

Radiator Shields
Metal Auto Parts Co., Inc.

Refrigerator Stampings
Metal Auto Parts Co., Inc.

Running Boards
Metal Auto Parts Co., Inc.

Running Board Shields
Metal Auto Parts Co., Inc.

Rust Proofing
American Chemical Paint Co.

Sawing Machines
Wittek Mfg. Co.

Screens, Woven Wire
Wickwire Spencer Steel Co.

Screw Machine Products
Barnes Co., Wallace Div. of Associated Spring Corp.

Screw Machines
Potter & Johnston Machine Co.

Seals
Oils & Grease
Chicago Rawhide Mfg. Co.

Shafting
Bliss & Laughlin, Inc.
Union Drawn Steel Co.

Shafts, Propeller
Spicer Mfg. Corp.

Shafts, Axles, Propeller and Transmission
Mechanics Universal Joint (Division Borg-Warner Corp.)

Shock Absorbers
Spicer Mfg. Corp.

Soldering Flux (Self-Cleaning)
American Chemical Paint Co.

Solvents
G. S. Blakeslee & Co.

Special Machinery
Baker Brothers, Inc.

Springs
Extension, Compression, Torsion or Flat
Barnes Co., Wallace, Div. or Associated Spring Corp.
Barnes-Gibson-Raymond, Div. of Associated Spring Corp.
Cook Plant of Barnes-Gibson-Raymond, Div. of Associated Spring Corp.
Gibson Co., Wm. D., Div. of Associated Spring Corp.
Raymond Mfg. Co., Div. of Associated Spring Corp.
Wickwire Spencer Steel Co.

Stampings or Drawings, Metal
Barnes Co., Wallace, Div. of Associated Spring Corp.
Barnes-Gibson-Raymond, Div. of Associated Spring Corp.
Cook Plant of Barnes-Gibson-Raymond, Div. of Associated Spring Corp.
Gibson Co., Wm. D., Div. of Associated Spring Corp.
Raymond Mfg. Co., Div. of Associated Spring Corp.
Worcester Stamped Metal Cor.

Stands, Reel (Coil Stock)
Wittek Mfg. Co.

Starter Switches (Automatic)
Bendix Products Corp.

Steel
Alloys
Bliss & Laughlin, Inc.
Carnegie-Illinois Steel Corp., U. S. Steel Corp. Subsidiary
Union Drawn Steel Co.

BUYERS' GUIDE—Continued

Bars
Bliss & Laughlin, Inc.
Carnegie - Illinois Steel Corp., U. S. Steel Corp. Subsidiary
Columbia Steel Co., U. S. Steel Corp. Subsidary
Jones & Laughlin Steel Corp.
Tennessee Coal, Iron & Railroad Co., U. S. Steel Corp. Subsidiary
Union Drawn Steel Co.
Billets
Carnegie - Illinois Steel Corp., U. S. Steel Corp. Subsidiary
Columbia Steel Co., U. S. Steel Corp. Subsidiary
Tennessee Coal, Iron & Railroad Co., U. S. Steel Corp. Subsidiary
Carbon
Bliss & Laughlin, Inc.
Carnegie - Illinois Steel Corp., U. S. Steel Corp. Subsidiary
Columbia Steel Co., U. S. Steel Corp. Subsidiary
Tennessee Coal, Iron & Railroad Co., U. S. Steel Corp. Subsidiary
Union Drawn Steel Co.
Cold Drawn
American Steel & Wire Co., U. S. Steel Corp., Subsidiary
Bliss & Laughlin, Inc.
Union Drawn Steel Co.
Electric Furnace
Bliss & Laughlin, Inc.
Carnegie - Illinois Steel Corp., U. S. Steel Corp. Subsidiary
Union Drawn Steel Co.
Shapes
Carnegie - Illinois Steel Corp., U. S. Steel Corp. Subsidiary
Columbia Steel Co., U. S. Steel Corp. Subsidiary
Tennessee Coal, Iron & Railroad Co., U. S. Steel Corp. Subsidiary
Sheets
Carnegie - Illinois Steel Corp., U. S. Steel Corp. Subsidiary
Columbia Steel Co., U. S. Steel Corp. Subsidiary
Tennessee Coal, Iron & Railroad Co., U. S. Steel Corp., Subsidiary
Spring
American Steel & Wire Co., U. S. Steel Corp., Subsidiary
Barnes Co., Wallace, Div. of Associated Spring Corp.
Barnes-Gibson Raymond, Div. of Associated Spring Corp.
Gibson Co., Wm. D., Div. of Associated Spring Corp.
Union Drawn Steel Co.
Stainless
American Steel & Wire Co., U. S. Steep Corp., Subsidiary
Carnegie - Illinois Steel Corp., U. S. Steel Corp. Subsidiary
Columbia Steel Co., U. S. Steel Corp. Subsidiary
National Tube Co., U. S. Steel Corp. Subsidiary
Rustless Iron & Steel Co.
Tennessee Coal, Iron & Railroad Co., U. S. Steel Corp. Subsidiary
Union Drawn Steel Co.
Vanadium
Union Drawn Steel Co.

Steering Gears
Ross Gear & Tool Co.

Tapping Machines
Baker Brothers, Inc.

Transmissions
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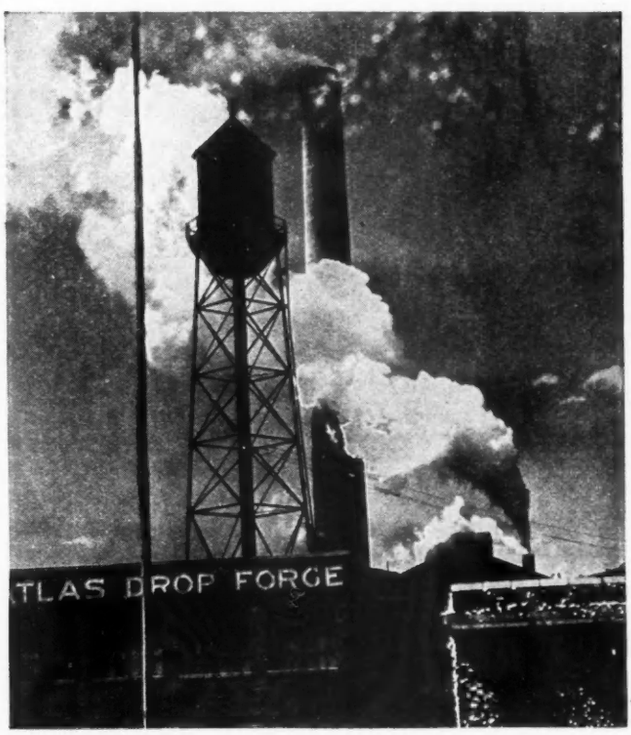

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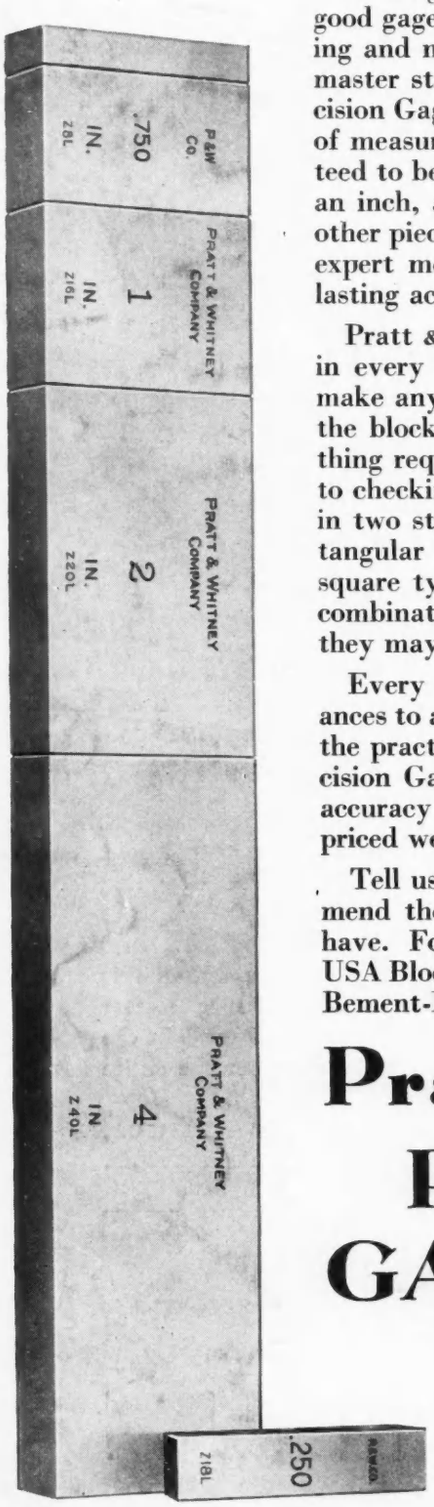

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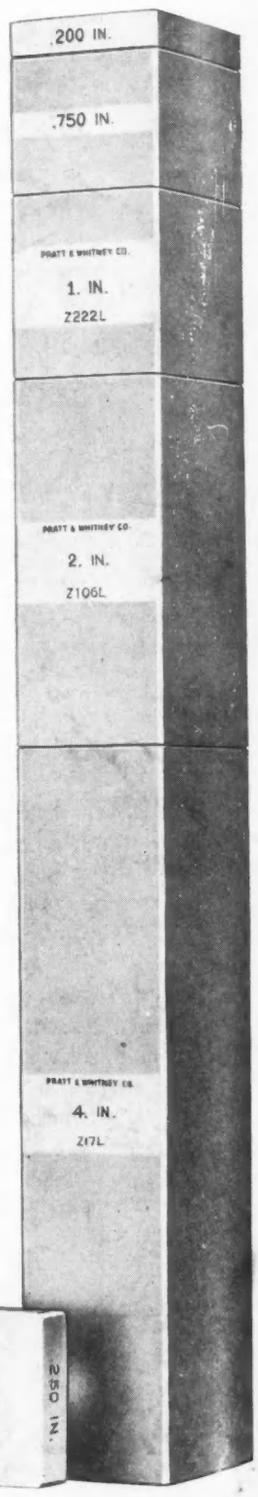

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